# GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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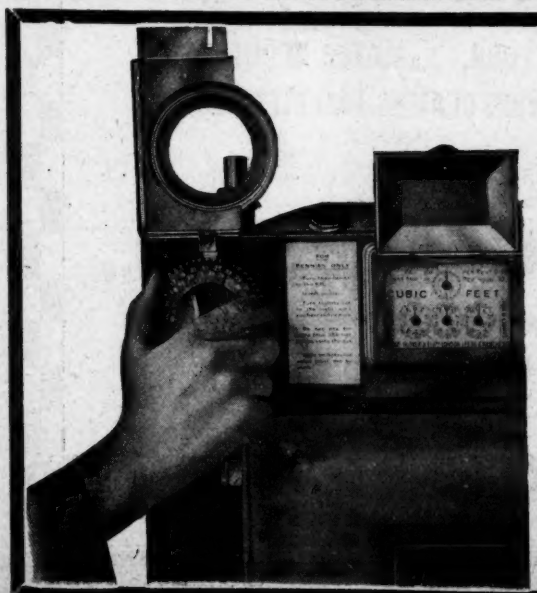

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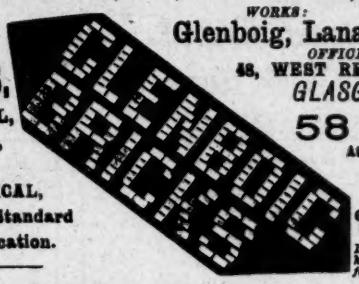

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLV., No. 3036.] WEDNESDAY, JULY 20, 1921. [73RD YEAR.


## EDITORIAL NOTES.

### Coal Contracts and Prices.

THE last has not by any means been heard of the grossly unjust decision by the coalowners in certain areas to increase the price of gas and household coal by 3s. per ton. There is indignation throughout the gas industry over this selective rather than a universal imposition of the burden, if the additional revenue is honestly necessary. It is simply piling a new hardship upon an industry that has been suffering an accumulation of hardships for years, including those brought upon them by the coal stoppage. The National Gas Council, we learn, have taken up the matter; and the Central Executive Board are asking the President of the Board of Trade to receive a deputation at an early date. If he cannot do so, an interview with the head of the Coal Mines Department should be sought. Failing the intervention of either the President or Mr. Bridgeman, then the Mining Association should be approached direct with a remonstrance and case against the proposal. It is stated in the minutes of the Central Executive Board that some interesting facts regarding the coal position were brought to light during the discussion at their last meeting; and it has been decided that meetings of the District Executive Boards should be convened at an early date, so that the whole of the industry may be kept informed as to the situation. A decision by the Cannock Chase Coal Owners' Association shows that there is not unanimity as to the necessity for increasing the price. They have passed a resolution not to advance it, as they are of opinion that "there is no "justification for it." We hope that this breaking-away from an arbitrary exercise of recovered power will be followed by other coalowners. At any rate, gas undertakings will take good care to buy all available suitable coal they can from areas where fair treatment can be secured.

The "Iron and Coal Trades Review," in a reference to contracts and prices, describes the market as obviously a "falling" one. The number of inquiries in regard to terms for contracts is "large;" but, as a rule, buyers are not anxious to fix-up at firm prices. These remarks of our contemporary coincide with those that we made last week. It also states that what is being done in many cases is to have "an arrangement for definite tonnage at the open market "prices ruling from time to time. In effect this is not a "contract, but the buyers are sure of securing their tonnage, "and at the same time obtain any price advantage that "comes along." The "Review" adds that for "the sake "of our economic position, we must have fuel at far lower "rates than are now ruling; and the arrangement in regard "to sales referred to, which is the line many collieries "are taking, appears to be a very advisable one." Yet in several districts the colliery owners have determined to hoist a further 3s. per ton on gas coal prices, while allowing all other industrial coal to go free! However, most buyers are waiting for more settled conditions. It is only natural after thirteen weeks' stoppage of the pits that there should be a scramble for supplies; and buyers in other industries are paying high prices—5s. to 10s. per ton more—to secure prompt deliveries. Buyers who can wait should therefore do so. The first rush will gradually tail-off; and prices must then descend. Gas undertakings are, of course, very anxious to return to the British coal to which they are accustomed. With imported coal, there have been mixed experiences; and those who had short gas makes per ton and indifferent coke will be glad enough to clear-out the remnant stocks of dear imported inferior stuff (from Continental quarters), and have home-produced material once more—home material, it is hoped, that can boast a greater cleanliness than the deliveries of recent years. Since the pits re-started, coals—especially from Yorkshire—have been delivered to some gas-works quite as freely as could have been expected. In fact, the latest reports inform us that in all coal areas public utility concerns are receiving special consideration in respect of supplies.

As to household coal, the retail dealers appear to be in somewhat of a quandary. In some places, prices have not been increased. In others, up to 5s. advances are spoken of, which means profiteering. But the summer is a bad time for domestic business, other than for stocking; and many households can now run completely on gas during the summer months, without troubling about solid fuel. The dealers know that care will have to be exercised, because, before long, it is believed that supplies will be in excess of the demand. The war and the coal strike, together with the insane policy of the Miners' Federation, have substantially changed market formations and conditions, both at home and abroad. Returns as to American coal exports are indicative of the change abroad. The total shipments in 1918 amounted to 19,954,100 tons; in 1919, to 16,393,600 tons; and in 1920, to 34,410,000 tons. The greatest expansion was across the Atlantic—rising from 4,280,600 tons in 1919 to 13,906,600 tons in 1920. This last compares with 923,300 tons in the year ended June 30, 1914. No doubt when the official figures for the strike months are available, it will be found that there was further enlargement.

### The Need for Reorganization.

THERE is an article in the current issue of the "Bulletin of "the Society of British Gas Industries" by Sir Arthur Duckham, the President, on "Organization in the Gas In-"dustry." It is an article frank, pointed, critical, and constructive—an article that is intended to stir up interest in the subject with which it deals, in the hope that something good and concrete will result. In this object it would fail if its circulation is confined to the members of the Society; and therefore we obtained the permission of the author to publish it in the "JOURNAL." Sir Arthur is now interested in contracting for gas and other plant. He was trained as a gas engineer, and served in the gas industry as one of its professional officers. Thus he is well able, from personal experience, to look from both sides at questions such as the one with which he is dealing, and this is more than many men can do with whom rests decision, which has again and again denied to an inseparable part of the gas industry the recognition and the place in its co-operative functions to which technically and commercially that part is entitled—never more so than to-day, when the most economical and efficient manufacturing plant and gas-consuming appliances are *desiderata*. This economy and efficiency can only be best realized by the closest possible collaboration and conference. Again and again, Sir Arthur has made no secret of the fact that he is dissatisfied with the compartmental organization of the gas industry, and the little existing evidence of mutual interest. And it has been a subject of perennial interest and advocacy in the "JOURNAL" from the time—during the Earl's Court Gas Exhibition—that the articles appeared in its columns which supplied the suggestion that led to the formation of the Society of British Gas Industries. The dissatisfaction of the writer of the article in the Society's "Bulletin" is, we know, that of many other men in the industry, who are equally as antagonistic to sham and detrimental divisions. He will therefore have a goodly following on the main point as to incompleteness of organization, and, to the extent of this incompleteness, a

deficiency which must be derogatory to the best influence and accomplishment in and by the industry.

We are with him thoroughly and whole-heartedly in his main object; but we are not prepared to accept every strut in the structure by which he supports it. Let us give an example. He writes: "The discontent has been often "voiced; but conservatism, smallness of view, and suspicion "have been too strong, and what should be the most virile "industry in the country is regarded by the general public "as decadent, and by the Press as of minor importance "when compared with our lesser sister of public utility—"electricity." The increase of gas consumption at present prices is a curious way for the general public to express their view as to the gas industry being decadent; it savours more of the growing recognition of gas being vital in the general system of our daily life. As to electricity, it is certainly not its better organization that causes the supposed greater attention to it; for, if anything, it has more organizations attaching to it—and organizations that in their functions overlap—than the gas industry. But there is a greater catholicity shown in respect of membership in its various bodies.

The different organizations of the gas industry come within the criticisms as to want of homogeneity and incompleteness in structure through the absence of an important element. We admit the defect; but neither Sir Arthur nor anyone else suggests that there is one of these bodies having real importance and tasks that is dispensable. They have each their own special functions; and there is admission in the article that they do their work well. No one body could do the work better. There would always—acceptance of this is in the scheme found later in the article—in any complete organization have to be specialization by competent sections, in order to secure the best work and results in each direction of activity. But the whole question is whether the work that is now done well within the limitations of qualification and power could not be better accomplished if organization was perfected by the eradication of artificial division and genuine discontent, so establishing happier conditions, by recognition and part where that recognition and part are only allowed at present from a distance. There is the Institution of Gas Engineers, formed for the interchange and development of technical ideas. But ruled-out from membership are the technical specialists of the contracting industry! Knowing what we do as to the qualifications of these technical men, the part they take in the progressive work of the industry, and the indebtedness of gas engineers and the industry to them, their isolation is really a serious matter, and the reasons for it fit subjects for derision. The thanks of the gas industry's professional men are shown in a singularly ungrateful way. Instead of admitting these engineers on terms of equality from the point of view of attainments, they are merely invited to attend the meetings as visitors, and are permitted, by condescension or toleration, to take part in the discussions, though not members.

Why this? Sir Arthur says "because the taint of com-"mercialism might demoralize the proper consideration of "scientific problems." In the taunt there is ridicule; and if it is one that is justified by fact, and not denied by the members of the Institution, then it shows that the members are themselves not proof against the taint. It is a sorry condition of things if this be so. And here is a convenient place to deal with a point that is made in a later part of the article. In the early days of the Society of British Gas Industries, suspicions were readily formed by some narrow-minded men that the new organization was a place where there would be hatchings and plottings in regard to fixing prices and exploiting purchasers, and to fostering malpractices. The Society has outlived all this hypothesis and suspicion, and has proved the contrary. Malpractice, instead of growing, has become less; and principally through the strength the Society gives in resisting demands. This diminution we have known. But the practice is not altogether dead. What is to be said of this statement from the article? "Certain contractors do offer or suggest considera-"tions for the placing of contracts; certain engineers and "managers ask for, or suggest, such considerations. These "are the chief offenders; but only less offenders are those "contractors who give when asked, and those who take "what is offered." And those who ask for and receive, or decline to place orders if refused, are they (we believe their number is small) members of the Institution of Gas Engineers? It is a fair contention on the part of Sir Arthur that it is by emphasizing the dividing-line between the two sides of the industry that these unfortunate occurrences are encouraged; while "if the industry became one homo-"geneous group, it is certain that broader and sounder "relationship would drive out malpractice." There is good sense in this, as a little careful examination by readers will easily reveal.

The work both of the National Gas Council and of the British Commercial Gas Association is praised by Sir Arthur. But the claim of the former to the title with which it has invested itself is not regarded as a legitimate one while one important element of the industry has not representation. The question as to the appropriateness of title is a small matter compared with the principal subject under consideration. As to the British Commercial Gas Association, there again "the position of the representatives of the "Contractors' Society is not of the same standing as the "representatives of gas undertakings."

## The Scheme.

THE article, as we have said, is not only critical of existing conditions; it is constructive. What it comes to is that Sir Arthur does not want dissolution of any of the existing bodies, save that he thinks, with the National Gas Council in existence looking after commercial and political affairs, that the Gas Companies' Protection Association could well be eliminated. We are of opinion that there is sufficient power and sentiment behind the Association to keep it in the land of the living, and to make itself felt, and that it will firmly but politely decline to be put to death. The Institution of Gas Engineers, the National Gas Council, the British Commercial Gas Association, the Federation of Gas Employers, and the Society of British Gas Industries should retain their individuality; but they should be members of one capital organization, which Sir Arthur suggests should be known as the British Gas Association, with representatives on the Council from each organization, and those representatives of equal standing. This would be the only body with a President; the constituent organizations would have Chairmen. There would be revision of certain of the constituent bodies. The author of the scheme does not claim representation of the Society in all the constituent bodies. All qualified gas engineers would be eligible as members of the Institution; the National Gas Council would have as its members only representatives of gas undertakings; and the British Commercial Gas Association would exist as at present. There is no claim that the Society of British Gas Industries, though contributors to the funds of the Association, should sit on its governing body; the only suggestion is that representatives of the Society should meet the Committee of the Association for discussion on particular points as occasion may arise. But the Federation of Gas Employers is a different matter. There should, Sir Arthur submits on excellent grounds, be representation on that body of gas contracting firms, in view of the fact that, as things are, they have wages and conditions different from those ruling in gas undertakings for the same kind of work. The result is that gas undertakings are constantly up against wages regulations and conditions governing the firms, and the firms frequently up against those governing the gas undertakings. Thus there cannot be, in the existing conditions, a coherent policy between the Gas Employers' Federation and the members of the Society of British Gas Industries; and therefore the submission that this is a quarter where the two bodies should work together.

One thing that strikes us about this scheme for a British Gas Association welding together these at present various floating bodies, and yet keeping their functions distinct, with blending where necessary, is the moderation of Sir Arthur regarding representation of the Society of which he is President. We are not prepared to say off-hand that there could not be improvement of his scheme for consolidation in a British Gas Association; but what we do assert is that it is a tentative plan put forward seriously for consideration and discussion, and well worthy both. Complete harmony and co-ordination in the gas industry are wanted. That way lies strength and the highest grade of work. It seems to us it would not be a bad thing to have on the matter a joint conference of the Councils of the various bodies. The scheme outlined here, and in greater detail in the article published elsewhere in this issue, would supply ample material as a basis for discussion; and we feel that

good would issue. We are constantly hearing of the tax that so many meetings of the different gas bodies are upon the time of gas men, especially of those who are on Councils and Committees, and have to attend their meetings as well as those of the general members held annually or half-yearly. Under the scheme limned-out here, the annual meetings would all be held at the same time. The procedure would be much on the lines of the British Association. The British Gas Association would meet, the President would deliver his address, and thereafter the different constituent bodies would be dismissed to simultaneous meetings under their respective Chairmen. Another good feature about what is proposed is that there is no dissolution proposed—at any rate, of real consequence. It is largely revision, and a bonding together in one head organization. It very strongly appeals to us as a simple way of attaining a much desired end. For the present, we leave the matter there—strongly urging the taking of steps to bring about the joint conference for discussion of the project. If there is a consensus of opinion among the counsellors of the industry that good would arise from this or a modified scheme, then by all means let us have it.

## Sulphate Production.

THE annual report of the Chief Inspector under the Alkali Works Regulation Act (Dr. T. Lewis Bailey)—successor to our old friend Mr. W. S. Curphey—is of the high standard of technical interest to which we have become accustomed through the enlightened view that the Alkali Inspectors—particularly the Chief—take of their duties and functions. It is a report which not only gives publicity to the work done by the inspectors, but is, as customarily, highly serviceable in respect of the information it incorporates as to experiences and new methods in the detail of operation. An example of this is the application by Mr. Alexander Yuill, of Dundee, of superheated steam to his sulphate of ammonia stills. He uses a coke-fired "Sugden" superheater, and reports that his yield of sulphate of ammonia has increased from 45 to 75 cwt. daily, or by rather more than 66 p.ct., owing to the increased quantity of raw liquor he is able to pass through the stills. Last year, it is seen, the ammonia products made in the United Kingdom (calculated on the basis of 24½ p.ct. ammonia) got closer to the 1918 figures than they were in 1919, when there was a fairly heavy drop in the total. The make last year was 418,881 tons, which was an improvement of 21,368 tons on last year's low figure, but still below the 1918 production by 13,670 tons. But the deficiency is entirely due to sources of production other than gas-works, which, as a matter of fact, gave a yield last year in excess of both 1919 and 1918. Gas-works in 1919 and 1918 contributed productions almost identical—the figures being 173,501 and 173,541 tons respectively. Last year gas-works yielded a total of 176,196 tons, which was a gain on 1919 of 2695 tons, or about 1½ p.ct. We are afraid that the return for 1921—due to the coal strike, the use of imported coal, and the large output of water gas—will show a falling-off. It is remarked that the manufacture of dry neutral sulphate is a growing practice. The loiterers in this matter will find that it will become compulsory.

## The Policy of Amalgamation.

CONSIDERABLE differences are being shown by the standard and maximum prices per therm that are being allowed to gas undertakings. Some show wide differences even for areas that are contiguous. There is no criticism as to the accuracy of the decisions of the Board of Trade. In adjoining areas, conditions justifying the wide differences may vary enormously. The fact was pointed out last week in our "Correspondence" columns by Mr. H. E. Jones merely with the view of emphasizing the importance of amalgamations with superiorly circumstanced concerns of those that are in inferior position in relation to the provision of supplies of gas. The areas of gas undertakings were originally mapped-out simply with the view of providing a local service; and it is obvious that not much consideration was devoted to basic economies other than within the limits of the defined area. No thought was given to the point as to whether linking-up with an outside undertaking would be economically an excellent thing. Now matters are very different. Time and new economic conditions, and developments in manufacture and in our knowledge of pressures, have emphasized the fact that the economies of an undertaking, well placed in regard to transport, manufacture, and business, can be oftentimes, with mutual advantage, communicated through connecting-pipes to a neighbouring area not so well conditioned. The months that have passed since the Gas Regulation Act became operative have not been altogether congenial in respect of the formulating and maturing of plans for fusions with the view to the greater distribution of economies. But Mr. Jones says now is the appointed time; and there is no question, with the changed position of expenditure, that prospects, both for shareholders and consumers, arising from fusion will be more obvious and more substantial now than ever before—always given appropriate conditions. Section 10 of the Gas Regulation Act, dealing with Special Orders, authorizes "arrangements "for the purchase by agreement, joint working, or amalga-"mation of undertakings, including necessary provisions "with regard to the capital of the combined undertaking, "the vesting of the property and rights of the purchased or "amalgamated undertakings, and other necessary incidents "and consequences of purchase, amalgamation, or joint "working." The Act therefore specially countenances and provides for amalgamations where there are apparent advantages in them; and the Board of Trade afford a simple route for obtaining all the necessary authorization.

## Money Economists and the Fuel Research Station.

THERE is a little uncertainty as to whether the economists who are anxious about the outpourings from the national purse have taken the initial steps in an endeavour to effect a piece of false economy by closing-down the Fuel Research Station, or whether certain interrogations of the Lord President of the Council (Mr. A. J. Balfour) in the House of Commons may be taken as a sign of genuine interest in the results of the researches that are being conducted at the station. If the latter is the correct reason for questions that have been asked in the House, then the surprise is that individual interest has not ensured possession of the publications that have already been made by the Director of the station and his active staff. If, however, the truth is that the interrogators are exploring the ground to discover reasons for putting an end to the excellent expenditure that is being made at the station, then in the interests of the nation it is hoped that their operations will be completely frustrated. The Fuel Research Station is a place, and the research carried on there is work, that it is to the interests of the country should be not only continued but developed, by the opening of fresh avenues of work as opportunity permits or occasion requires. Before the war, this country was wasteful with its fuel, and it was not expending upon its research money to a corresponding degree with Germany; nor is it doing so even to-day. The result was that steadily, if not rapidly, Germany was getting in advance of certain of our industries, and in other directions we were positively unable to compete commercially with that country. We are not holding-up Germany as a model in this respect; but what is desired is to emphasize that that country had long before the war fully realized that research is the way of progress, while the truth had only been partially realized by this country. It was through the developments of research that Germany was better prepared for war than we were; it was through its researches that it was able to hold-out so long without any assistance going to it from the outside world through the effective blockade that was maintained. Industrial progress in peace and preparedness for war are united in a very close manner; and it is industrial progress in peace that it is the capital aim of the Fuel Research Station to serve.

Fuel economy is one way of subscribing to coal conservation, increasing industrial efficiency, and, through it all, contributing to national economy and prosperity. And the researches that are being made at the station will help to show how the best results can be secured from the raw materials that are available as fuel, or are the bases of products required in various industries. The Research Station is altogether different from anything pre-existing. Scientific experiments on a laboratory scale are prosecuted elsewhere; but that is not the same thing as is being done at East Greenwich. There we have working-scale operation to which all the refinements of the laboratory are applied, and the results of the operations are subjected to examination, from the chemical and physical standpoints, with scientific exactitude. The importance of this to industry is more apparent to the technician and commercial man than probably to politicians. Some politicians have a very misty notion as to the value of

it all to industries, and through industries to the nation and workers generally. The thorough exploration that is proceeding will enable a lessening of waste in industries. It will set up new standards to which industries may work in regard to heat, power, and products. It will show how the most profitable results in these respects can be obtained from raw materials. This means economy. It will help to eradicate erroneous theories, and put facts in their place. In many ways the work will serve the nation; and it is work that is best done by the nation, and therefore paid for from the common purse. Of course, results cannot be expected to accrue in a day. Much patient work, with over it all the exercise of care, which means time, has to be done. It would be an evil day on which an end was put to one of the best practical pieces of productive work the Government has ever instituted, and which has been developed by Sir George Beilby on lines of economy consistent with efficient performance. When we consider the detail work that has to be done in connection with operations on a working scale, and the spaciousness of the work and the interests concerned in it, a staff of twelve scientific and technical men, with an industrial and clerical staff of 77, constitute an organization that does not err on the elaborate side. The cost this financial year will be approximately £44,000. As we have seen recently by an inspection of the station, the money has been and is being well spent. At East Greenwich the nation has something beneficial in purpose and result, and of which it may well be proud. To seek financial economy by ending this work would certainly result in a much overbalancing contra of national loss.

## Zoning and Grading.

It is understood that, an agreement having been reached in the south-western district, the complex question of zoning and grading has now been settled throughout the country.

## Gas Wages Reduction.

The reduction of gas-workers' wages recently agreed to will apply to all adult gas workers—including gas-fitters—who received advances under the agreement of June 30 last year.

## Sale and Hire of Gas Apparatus.

In our "Correspondence" columns to-day, the Chairman of the Wandsworth, Wimbledon, and Epsom District Gas Company (Mr. H. E. Jones) deals with the report of the Sub Committee appointed under the Profiteering Acts, which report was noticed in our editorial and news columns last week.

## Shareholders and Market Values.

We have previously warned gas share and stock holders against parting with their holdings in these days. It is the worst time possible. The financial position of the gas industry is improving and will improve, now that the Orders that are being issued under the Gas Regulation Act are coming into operation. Mr. H. E. Jones, speaking at the European Gas Company's meeting last week, said gas properties were regaining value rapidly; and therefore he urged that on no account should the holders part with their shares or stocks. It troubles him, sitting at some Boards, to see transfers passing through; and he is afraid it is principally due to stress of circumstances that there is this parting with holdings. It is unfortunate just at a time when things are mending. Only stern necessity should induce a change of ownership.

## Great Britain's Oil Policy.

A great deal of unnecessary fuss has been made in America over the oil policy of this country. We have been accused of doing many things we are not doing; and, if we were, it would not be the business of anyone else, and would only be with the legitimate desire to protect ourselves, and ensure our requirements. Lord Curzon has taken up the matter, and has prepared a memorandum dealing with it. The document shows that this country is not co-operating with commercial interests to secure an undue share of the petroleum resources of the world. Great Britain is, next to the United States, and (in normal times) Russia, the largest consumer of oil in the world. Over 90 p.ct. of her navy is oil-fired (as compared with 45 p.ct. before the war), as is a rapidly increasing proportion of her merchant marine. Her present home resources consist of one well giving a daily production of a ton, and Scottish shale-fields which yield about 165,000 tons of oil products annually. In 1920, Great Britain imported about 3 368,600 tons of oil (motor spirit, kerosene, fuel oil, lubricants, &c.) of a total value of £67,000,000. Of this, 61 p.ct. in quantity and 68 p.ct. in value came from the United States, 37 p.ct. in quantity and 30 p.ct. in value from other foreign countries, and 2 p.ct. in quantity and 2 p.ct. in value from British Possessions. During the war the annual imports of petroleum rose as high as 5,160,000 tons. Although the consumption of Great Britain per head is only about one-sixth of that in the United States, her requirements are nevertheless very large, and are at present met almost wholly from foreign countries at an extremely high cost. Although it is hoped that British interests will take an increasing share in the development of the world's oil resources, any suggestion that British domination is intended or possible is entirely unfounded. It has been frequently alleged that Great Britain has secured control of half the petroleum deposits of the world, but statements of this kind are based on entirely inadequate data. It is, however, becoming increasingly obvious that there is ample scope for the activity and enterprise of all nations in searching for, and bringing into use, the world's stores of petroleum as yet undiscovered.

## Engineering Wages Reduction.

The country has arrived at the end of the big industrial discussions over the first claims for reductions of wages, and which have involved most of the big industries. It is a satisfaction to find that in the labour world there is such a considerable part of the men and trade union leaders who recognize that wages costs could not continue as they were if there was to be a revival of trade in the country and work was to be created for all who want it. It was gratifying to find that no less than 61·64 p.ct. of the men who balloted on the question of the reduction of wages in the engineering trades were favourable to the acceptance of the terms agreed by their leaders and the employers' representatives—viz., 3s. a week on time rates on July 15, and a further 3s. on August 15. The actual figures were: For acceptance, 175,145; against, 108,969—majority in favour, 66,176. This last-named figure left no question as to the major sense of the men, though it is somewhat remarkable that in the engineering industry there could be found so many as 108,969 men who considered the industry could be kept alive and flourishing, with the competition of other countries to meet, at the rate of wages that has been prevailing. Either these men could not have thought much about the matter, or they are incapable of adding together two and two. The Ministry of Munitions percentages of 12½ to time workers and 7½ to piece workers are to be discussed at a joint conference of the unions and employers in September. Now these leading wage reductions have been settled, it is hoped that the industries will be able to push forward, and so be prepared to share in the trade revival that the prophets assure us is coming to a much impoverished world.

## Gas Oil.

In the first six months of this year, 23,909 598 gallons of gas oil were imported, compared with 30,653,170 gallons in the first six months of last year. But June of this year saw a delivery of 7,181,277 gallons, compared with 6,535,821 gallons in June last year. The lower price of recent weeks has produced a much larger demand.

## Dyestuffs Industry Development Committee.

The Board of Trade announce that, in accordance with the provisions of section 2 (6) of the Dyestuffs (Import Regulation) Act, 1920, the President of the Board of Trade has appointed a Committee to advise them with respect to the efficient and economical development of the dye-making industry. The members of the Committee are: Mr. W. J. U. Woolcock, C.B.E., M.P. (Chairman), Mr. Percy Ashley, C.B. (Board of Trade), Sir Henry Birchenough, Bart., K.C.M.G., Mr. W. H. Dawson, Mr. George Douglas, Mr. E. V. Evans, O.B.E., F.I.C., Dr. M. O. Forster, F.R.S. (Director of the Salter Institute of Industrial Chemistry), Mr. L. B. Holliday, Dr. Herbert Levinstein, F.I.C., Prof. G. T. Morgan, F.R.S., Mr. James Morton, Mr. Max Muspratt, Mr. Thomas Taylor, Mr. Norman Thomas (Admiralty), Mr. G. S. Witham (War Office), together with another representative of the dye-using interests to be nominated shortly.

## ALKALI WORKS CHIEF INSPECTOR'S REPORT.

In the fifty-seventh annual report of the series (which deals with the work carried out during the year 1920), Dr. T. Lewis Bailey, F.I.C., who succeeded in September last Mr. W. S. Curphey as Chief Inspector under the Alkali Works Regulation Act, refers to the great services rendered by that gentleman over a period of forty years. Mr. Curphey, he says, was appointed Assistant to Dr. Angus Smith in 1877, became Inspector in 1882, and carried out the duties of inspection in the North of England, Ireland, and Scotland prior to his appointment, in 1910, as Chief Inspector for the British Isles. During the ten years in which he held office as Chief Inspector, considerable changes have taken place in the chemical processes that come under the jurisdiction of the Alkali Inspector; and much work of special character became necessary in consequence. To mention one thing, bye-product ammonia has provided many problems; and much attention has been paid to means for dealing with the noxious gases emanating from sulphate of ammonia plants. Again, the direct process for the manufacture of sulphate of ammonia has received full consideration; and the work done in this connection has resulted incidentally in the introduction of greatly improved methods of desulphurization of coal gas. The past year has witnessed the retirement, also, of Dr. Alfred C. Fryer, who had been Inspector for the West of England and South Wales since 1884. Synchronizing with Dr. Bailey's appointment as Chief Inspector, it was decided that the inspection of works in Scotland should no longer be under the supervision of the Chief Inspector for England, Wales, and Ireland; and Mr. J. W. Young, B.A., B.Sc., the Inspector resident in Glasgow, was appointed Chief Inspector for Scotland, under the Scottish Board of Health. Reference is made to the death of Mr. Alfred E. Fletcher, who was Chief Inspector from 1884 to 1895; and of Mr. Herbert Porter, of Liverpool. Dr. Bailey says: "Mr. S. E. Linder, B.Sc., whose work in the past with my predecessors has been so consistently valuable and so ungrudgingly given, will continue to act as the Chief Inspector's assistant."

### Registered Works.

In the year under review, the number of registered works was 1383, of which 58 were registered as "alkali works." There was thus a decrease of four in the number of alkali works registered, and of sixteen in the number of other works. The number of separate processes of manufacture under inspection in 1920 was 2241, against 2288 in the previous twelve months. Exigencies of the war period are indicated by a comparison of the processes since 1914. The number of gas-liquor works registered in that year was 56; but by 1916 it had risen to 81, and by 1919 to 107. Now the figure is back to 92, which, it is remarked, points to somewhat altered conditions from those of pre-war days. The variations noted were, of course, due to fluctuations in the number of works producing concentrated ammoniacal liquor. The visits made to works during the year increased by 10 p.ct., and of tests carried out by 17 p.ct. Owing to the prevailing adverse conditions, no visits were paid to works in Ireland. Though there were more complaints than usual, no cases arose in which it was necessary to prosecute.

### Accidents.

The year was fairly free from serious accidents due to noxious gases; but three fatalities occurred at tar-works. In one case a workman was overcome while clinkering the still fire; the bulk of the evidence pointing to poisoning by carbon monoxide. In the other instances the cause was sulphuretted hydrogen, inhaled during the cleaning of plant interiors. The fact is emphasized in the report that during the cleaning of stills, physical isolation is absolutely essential, as also is thorough ventilation. Sulphuretted hydrogen is responsible for the gassing of four men at a coke-oven works sulphate of ammonia plant; but fortunately all recovered. This accident occurred during the clearing of a blockage. Note should be made of the desirability of at once informing the District Inspector of such cases as these, so that, with a view to the prevention of like accidents, investigation may be made before important details have escaped the memory of those present at the time.

### Sulphate and Muriate of Ammonia and Gas Liquor Works.

The number of works registered for sulphate and muriate of ammonia was 631, a decrease of one on the previous year. As already remarked, however, the number of gas-liquor works fell from 107 to 92. This, it is pointed out, does not mean the closing of works, but rather indicates that in those works where facilities had existed for making either salts of ammonia or concentrated ammoniacal liquor, according to the demand, sulphate of ammonia has been produced solely—the abnormal requirements as regards concentrated liquor supply having disappeared. All over the country the bye-product ammonia trade has been very brisk throughout the year. There were complaints received alleging the emission of sulphuretted hydrogen from one large sulphate of ammonia works. It was found, however, that the whole installation was new, and was worked by men unused to the manufacture of sulphate on a large scale. There was a tendency to run the purifiers too long without renewal; but the methods of working quickly improved.

*Ammonia Products Manufactured in the United Kingdom (expressed in Terms of Sulphate, 24½ p.ct. $NH_3$)—Tons.*

| From Liquor Produced in— | 1920. | 1919. | 1918. |
|---|---|---|---|
| Gas-works | 176,196 | 173,501 | 173,541 |
| Iron-works | 10,441 | 10,877 | 12,717 |
| Shale-works | 54,290 | 48,618 | 58,311 |
| Coke-oven works | 157,908 | 144,367 | 164,448 |
| Producer-gas and carbonizing works (bone and coal) | 20,046 | 20,150 | 23,534 |
| Total. | 418,881 | 397,513 | 432,551 |

NOTE.—Of the above total quantity of ammonia products, the equivalent of 40 207 tons was manufactured as concentrated ammoniacal liquor; the balance of 378,674 tons consisted of other ammonia products (sulphate, chloride, nitrate, &c.).

The production of a dry neutral sulphate of ammonia is receiving increased attention; and arrangements for the installation of plant with this end in view are being made at a number of works.

### Oxidation of Ammoniacal Liquor by Air.

There is a section of the report which deals with the oxidation of ammoniacal liquor by air; and it will be found reproduced on p. 161 of this issue of the "JOURNAL."

### Purification by Oxide of Iron.

The first portion of the report which relates to the subject of purification by oxide of iron appears on p. 162.

### Tar-Works.

Tar-works have been very actively engaged in the period to which the report refers. Complaints have of late been received against a tar-works situated in a thickly populated neighbourhood. Pitch fumes, says Dr. Bailey, are very unpleasant, and particularly so if the pitch is run to the bays at too high a temperature. Careful and extensive investigation has been made, so far as the distillation of tar is concerned. Suggestions have been put forward with a view to improving control and general conditions; and these suggestions are being acted upon. The report repeats here that it is even yet necessary to call the special attention of tar distillers to the need for physical disconnection of stills, when these are being cleaned or are undergoing repair. Men should not be permitted to enter stills unless these have been disconnected.

*Tar and Pitch in the United Kingdom.*

| | Tons.* |
|---|---|
| Tar distilled in— | |
| Gas and coke-oven works | 1,450,535 |
| Other works | 117,788 |
| Pitch produced in— | |
| Gas and coke-oven works | 677,295 |
| Other works | 63,468 |

* One ton of tar taken to contain 190 gallons.

## REPORT FOR SCOTLAND.

In the report which he has presented to the Scottish Board of Health, Mr. J. W. Young states that the number of works registered was 166. Of the 317 processes carried on by them, 13 were gas liquor, 109 sulphate and muriate of ammonia, and 53 tar. In no case were the statutory limits prescribed in the Acts exceeded; and there was no fatal accident reported in connection with any registered process.

*Ammonia Products, Tar Distilled, and Pitch Produced.*

| | | 1920. Tons. | 1919. Tons. |
|---|---|---|---|
| Salts of ammonia (expressed as sulphate)— | | | |
| From gas-works | 21,440 | | |
| Iron-works | 9,685 | | |
| Shale-works | 54,290 | | |
| Coke, producer-gas, and carbonizing works | 16,484 | | |
| | | 101,899 | 96,745 |
| Tar distilled— | | | |
| At gas and coke-oven works | 141,546 | | |
| At other works | 103,551 | | |
| | | 245,097 | 260,275 |
| Pitch produced— | | | |
| From gas and coke-oven works | 62,261 | | |
| From other works | 57,780 | | |
| | | 120,041 | 117,964 |

In connection with sulphate of ammonia and gas-liquor works, Mr. Young also remarks upon the increased attention given to the neutralization of the sulphate of ammonia manufactured, and says that "manifest advantages to the farmer at home, and to buyers abroad, will render the sale of damp acid salt less easy."

Note is made in the report of important progress in the manufacture of sulphate of ammonia established by Mr. Alexander Yuill, of Dundee, who now supplies to his stills steam superheated. Wet steam is a frequent trouble at these works; and for long Mr. Young has looked forward to its cure. It seems that Mr. Yuill employs a "Sugden" superheater, fired with coke. He reports that his yield of sulphate of ammonia has increased from 45 cwt. to 75 cwt. daily—*i.e.*, by 66 p.ct.—owing to the increased quantity of raw liquor he is now able to pass through his stills. Previously, wet steam at 28 lbs. pressure was used, with a constant and wasteful drip of water from the drain-cock. Now the pressure of the dry steam is 22 lbs., and its temperature 355° to 400° Fahr. The superheater has a capacity of 4100 lbs. an hour,

and supplies steam also to drive the tools of the machine shop; so the chemical plant consumes only a portion of the 10 cwt. of coke used for daily firing. The furnace is cleaned once daily.

Mr. Young goes on to point out that at the smaller gas-works it is a common sight to find in the sulphate house the floor distorted by upheaval and expansion below, resulting from loss of acid and mother liquor through unnoticed or unchecked leaks. Frequently this distortion inclines both still and saturator from their designed positions. Sometimes connecting pipes are broken—at the least, the joints are strained—trays of the still are out of level; and the cracker pipes of the saturators are imperfectly sealed in mother liquor. If the plant can be worked at all, yield is diminished and ammonia passes forward, wasted, to the purifiers. To prevent this percolation of acid liquor into the soil, he has advised the use of flooring material resistant to acid and suitably drained, and the erection of the chemical plant so that any leakage is at once apparent. There seems advantage in the permanent support of the saturator by wedges, as its level can then be kept in accurate adjustment.

As to tar-works, attractive prices for pitch and other products encouraged active working. Several new plants were erected also to dehydrate tar for road purposes; and these have an additional use in the preliminary treatment of tar before actual distillation. Mr. C. W. Walker, of the Carnbroe Chemical Company, has removed much of the danger and inconvenience inseparably attendant on the cleaning of his tar-stills. The necessity for cleaning and the weight of dirt are greater than usual, so that the task is laborious, dangerous, and expensive. Near the base of his stills at Coatbridge and at Shotts, Mr. Walker has provided an extra manhole, covered when in use by replaceable lagging. When it is desired to clean a still, both the upper and lower manholes are uncovered. Cooling is thus hastened, and entrance less delayed. The men work inside in greater comfort, and with perfect safety. Compulsory provision of such manholes universally would, Mr. Young declares, have saved many lives.

## ELECTRICITY SUPPLY MEMORANDA.

THE inquiry into the London and Home Counties electricity schemes has been running on for weeks; and there are men in the electricity supply industry who are getting sorely troubled over the amount of the costs incurred, with no prospect of seeing within reasonable time the consummation of their hopes in this respect. The expenditure has been referred to in the House of Commons; certain of the electrical papers have made reference to it, and complained that much time is being wasted over trivial matters; and where electrical men have been meeting together, there has been talk of the heaviness of the outlay upon which the industry has launched, and doubts are growing as to economies in generation ever producing due compensation. Then again it was thought at one time that there would be no end of waste heat that could be collected, which could be made use of in generating electric current. Now fuel economy and thermal efficiency discussions are opening the eyes of those who were harbouring hopes in this direction to the fact that available coke-oven gas is earmarked for town supply, as its use under boilers for generating steam would be a wicked waste, while other forms of waste heat are now being utilized more and more by producers themselves, and so contributing to the works' economy. Then again it was thought that the railway companies would become large patrons of the Joint Electricity Authorities. The railway companies have other ideas. They find that they can do better by generating for their own needs; and if they have any surplus energy, they will be able to supply the Joint Authorities in their outer areas more cheaply than the Joint Authorities could furnish the supply. In one of the discussions at the Institution of Civil Engineers, Mr. Roger T. Smith said that Parliament seemed to consider in the Electricity Act that railways should have the opportunity of buying in the cheapest market; and they could therefore obtain approval from the Electricity Commissioners to build their own stations, unless the Joint Electricity Authority could satisfy the Commissioners that they could supply as cheaply as the railway companies themselves. But against this is the fact that the whole of the electricity powers of the Board of Trade and Ministry of Health were transferred to the Ministry of Transport; and there is no doubt the original intention was that the electricity supplies to the railways should be from the Joint Authorities' stations. In many respects, however, hopes are vanishing; ideals and plans are being shattered.

**Shattered Hopes and Plans.**

It was only natural that, during the engineering conferences in London the other week, when so much was heard about thermal efficiency and the methods of producing greater fuel economy, the electrical industry should wish to have a look in. It cannot claim high thermal efficiency; but the desire to improve its reputation in this respect is quite strong, though, on paper, nothing higher than about 20 p.ct. appears to be obtainable. In practice the efficiency, omitting very poor working, lies between 5 and 7 p.ct. The idea that has the greatest attraction is to increase the thermal efficiency by utilizing exhaust steam for power, heating, &c., so regarding this as a by-product of electrical generation. The problem of utilization in this way is quite old now; and it is a problem still, though there has been much talk regarding it. What practical application there has been has not been of an encouraging nature. One of the papers at the Civils Conference was by Mr. E. R. Dolby; and he seems to think it a practical proposition to collect the exhaust steam from scattered prime movers, and utilize it for developing power or electrical energy, and supplying steam and hot water for heating, drying, and cooking. He suggests that sets of mains should be provided for public utility—one set to receive electrical energy in the form of alternating current at a standard pressure and frequency, another set to receive steam at a pressure of 5 to 10 lbs. per square inch, while a third set would deliver water at a temperature of 120° to 200° Fahr. There would be payment for the heat delivered into the system in the shape of exhaust steam; and the consumer would pay for what he used. The bye-products—energy, steam, or hot water—could be used not only for industry but for domestic purposes. As to the methods of allocating charges to the various purposes for which heat is utilized, the author is of opinion that the thermal units employed for each service should be charged to that service, and that all costs of labour, fuel, stores, taxation, interest, and sinking fund should be charged *pro ratâ* on the thermal units consumed by each service. Mr. Dolby believes that there are savings to be effected in connection with electrical generation which would enable a reduction of the charge for energy well below the ordinary rates.

**Exhaust Steam a Bye-Product.**

The scheme looks as though the capital expenditure and the heat losses that would be incurred in producing something of public utility would render the resulting convenience too expensive for industrial use and for the domestic pocket. We know that Mr. S. L. Pearce, the Electrical Engineer of Manchester, not long since reported that his personal inquiries in America did not inspire him with much hope of utilizing waste heat in this manner, and his small experience in Manchester was not of a convincing kind as to financial success. There were believers and doubters in the discussion. One speaker expressed the view that the efficiency of many electric power stations could be doubled by utilizing the exhaust steam; but he does not appear, from the report before us, to have given any idea as to the cost of obtaining the doubling of efficiency, and as to whether there would be financial success. There is Mr. Patchell who inclines to the view that the distribution of exhaust steam and heat for district service would not pay in this country—at any rate, for domestic or office work. Another speaker gave it as his opinion that the project would not pay in an existing town; but it might in the case of a garden city or a housing scheme where there was no electricity supply. It transpired that the Institution of Heating and Ventilating Engineers are considering the matter in conjunction with the Institution of Electrical Engineers, to ascertain whether it is possible to arrive at a common basis on which to make use of this waste-heat product. Mr. Dolby did not show that he was greatly encouraged by the discussion; but he did think that public baths might dispense with their boiler plant, and utilize the waste heat from electricity generating stations. To make a scheme of the kind a success, it seems to us the load would have to be fairly constant; and that constancy could not be obtained in all areas. The capital required for a (to prevent heat losses) thickly insulated distribution system would be heavy; and for the capital to lie intermittently idle would be financially disastrous. We have seen nothing yet to persuade us that the problem of utilizing this particular form of waste heat has been solved—particularly on the financial side; and there is nothing in sight to raise our expectations that the utilization of exhaust steam for public purposes in the way proposed is going to be a development in the near future. The paper has not altered the *status quo* of the problem.

**Increasing Efficiency and the Cost.**

There was a piece of information in our news columns last week as to the position of gas and electricity in connection with the housing scheme at Glasgow; and we are glad to see that the General Managers of both Corporation departments take an enlightened view of the matter. Mr. J. W. M'Lusky, the General Manager of the Gas Department, and Mr. R. B. Mitchell, the General Manager of the Electricity Department, are convinced that a division of the custom between gas and electricity would result in a capital expenditure which would find no compensation in the split revenue. This is a sensible view to take when dealing with four-roomed houses. There are only to be twelve such houses to the acre; and costly cables, if laid for lighting, could not pay. Gas-pipes would not cost so much; but then there is in this case the cost of the cooker, wash-boiler, &c. It is better to look the facts in the face as, in their reports, Mr. M'Lusky and Mr. Mitchell have done. Regarding gas, it is estimated that 26,000 c.ft. would have to be consumed per annum before any profit is made—4000 c.ft. for lighting and 22,000 c.ft. for other purposes; and the average revenue per house would be £5 19s. 2d. at the present price of gas. In the case of electricity, it is suggested that the tenant should pay £4 11s. as a fixed charge and ½d. per unit consumed; and for an all-electric four-roomed dwelling, it is calculated that 3250 units would be consumed per annum, which at ½d. per unit would amount to £6 15s. 5d. The fixed charge and this item make £11 6s. 5d., which is considerably in excess of gas. We should like to know

**Housing and Necessary Consumption.**

if the electricity consumption includes lighting, cooking, a wash-boiler—in fact, if the conveniences offered are on all-fours with gas. There is doubt. Anyway the figures show that a considerably higher revenue would have to be obtained from electricity than from gas before a profit began to accrue. Mr. Mitchell suggests that an area should be allocated to gas and one to electricity respectively for "all-gas" and "all-electric" four-roomed houses. We should be sorry for the poor tenants if they were compelled to use electric-cookers and electric wash-boilers at the higher cost. Why should they be? And yet whatever is included, it is computed that, even at only ½d. per unit *plus* the fixed charge, the cost to them would be no less than £11 6s. 5d. per annum!

**House Rent plus Electricity Accounts.**

It is noticed that at Liverpool a number of the tenants of the Corporation dwellings at Knotty Ash have been resisting the payment of their electric light accounts. Some singular electrical people are talking of making an inclusive charge in the rental of dwellings to cover electric lighting; but with plain rents running from (say) 16s. to 25s. a week, the houses would not meet the requirements of the class of people for whom they are intended if the rents were still further raised with a view to including electricity in a lump payment. The Knotty Ash tenants regard a rent of 16s. to 20s. a week as "high;" and when, in addition, they received accounts for electricity used for lighting, they were painfully disappointed. Thirty or more of the tenants refused to pay the accounts, having been under the impression that the rents included lighting. They were summoned for non-payment; and now they are wiser. At the Police Court they were told there was no ground for their assumption; and therefore they would have to pay. We can see some of these tenants adopting oil-lamps and candles, if they cannot have gas on the slot-meter system.

**Overhead Wires.**

Reverting to the Institution of Civil Engineers conference, there was some discussion on electricity transmission by overhead wires. Both for transmission purposes and for housing schemes, overhead wires have been advocated on the ground of economy. But there is a changing opinion on the subject. There are now engineers who think that the initial economy will be largely off-set by the cost of maintenance. Some engineers are of opinion that there is no other solution to the problem of electricity distribution in rural areas than overhead cables; while others point out—most probably having been awakened by recent events in connection with telegraph and telephone wires and railway signals—that overhead lines would be very liable to attack by the King's enemies. This would indeed be important to industrial establishments where there was entire dependence on electric power. Another speaker stated that he had given up the idea of using overhead wires for a housing scheme on the ground of the cost of maintenance—more especially as excavation costs were reduced by doing the work during the construction of the houses, while the roads were "up" for other purposes. There is wisdom in these changed views.

**Retrospective Charges.**

Reminder is given of the attempt of the Kingston-on-Thames Electricity Department (with the connivance of the Electricity Commissioners) to inflict on the consumers an increase of charge retrospectively above the maximum that was then the legal limit. That there was no justification, quite apart from the legal aspect of the matter, is shown by the fact that for the year ending March 31 last a net profit was made of £697. Had the Corporation succeeded in their attempt, the net profit would have been much and unnecessarily larger; but fortunately the opposition, combined with counsel's advice, was too strong for them to proceed with their ill-advised proposal. At Dundee we see that, with a deficit on the past year's working of no less than £8068, an over-all increase of 20 p.ct. is to be made in the electricity charges—retrospective to May last. The proposal cannot be examined here from the legal aspect, because we are not in possession of the conditions; but at any rate retrospective increases are opposed to general practice, and are not fair to consumers who have been giving their custom on the strength of prevailing prices.

**Big Scheme for the Sheffield District.**

The Sheffield Corporation have introduced a large scheme for the constitution of a Joint Electricity Authority for the North-East Midland District. The area comprises Sheffield, Rotherham, Buxton, Chesterfield, Doncaster, Worksop, Retford, Brigg, Gainsborough, Scunthorpe, and a number of other urban and rural districts. The scheme deposited is a very comprehensive one—providing among much else for large generating stations, transformer stations, and the purchase of as much of the undertaking of the Yorkshire Electric Power Company as is within the district. Authority is also to be sought to let for hire, manufacture, sell, or otherwise deal in, electric fittings, and apparatus and appliances for lighting, heating, motive power, and other purposes. It is suggested that the authority shall consist of eighteen members, twelve of whom will be appointed by the Sheffield and Rotherham Councils, and one each by the Borough Councils of Chesterfield and Doncaster, and the County Councils of the West Riding, Derbyshire, Nottinghamshire, and Lindsey. The plans include the power to purchase or take over any electrical undertaking or part thereof situated within the district, as well as the linking-up of existing stations. Regarding finance, it is provided that the expenses of the authority shall be met by (1) proceeds of the sale of electrical energy and revenue derived from the business of the authority; (2) grants from the Imperial Exchequer on the recommendation of the Commissioners; (3) contributions given voluntarily or by agreement by local authorities, and authorized undertakers within the district. The prices for energy are to be fixed by the authority subject to the approval of the Commissioners. No other scheme has been suggested for this particular area; and there are indications that there will be tremendous opposition from the various local authorities in the district. Regarding this, it will be as well to wait developments until a complete consideration of the proposals has been given to them by the various authorities.

## NATIONAL GAS COUNCIL.

### Meeting of the Central Executive Board.

A MEETING of the Central Executive Board of the National Gas Council was held on Tuesday last week, at No. 30, Grosvenor Gardens, S.W.—Mr. D. MILNE WATSON in the chair.

COAL.

Reports from all quarters showed the very serious position in which many undertakings were placed owing to the losses they had sustained in consequence of having had to purchase foreign coal at inflated prices. The recent suggested impost by coal-owners and factors of 3s. per ton upon coal to gas undertakings and for domestic use considerably aggravated the position, and was grossly unfair to an industry which had been the means of maintaining the country's gas supply at a most critical period, at considerable sacrifice to themselves.

It was reported that, upon the recommendation of a special meeting of the Central Executive Board, held the previous week, a letter had been sent by the Council to the Board of Trade requesting that the President receive a deputation upon the matter at an early date.

A very lengthy discussion followed, at which most interesting facts were brought to light with regard to the question of coal; and it was decided that meetings of the District Executive Boards should be convened at an early date, so that the whole of the industry might be kept informed of the situation.

GAS REGULATION ACT.

It was resolved to ask the Director of Gas Administration at the Board of Trade not to accede to a request which he had received to the effect that the month of August should not be counted in the period allowed for objections to applications for Orders under section 1 of the Act.

ELECTRICITY SCHEMES.

It was reported that the inquiry at present taking place before the Electricity Commissioners was merely a preliminary inquiry with a view to determining which, out of six proposed schemes, should be adopted. When the Electricity Commissioners have approved a particular scheme as a result of the present inquiry, it is their intention to embody such scheme and their decisions in a draft Order, which will be published in accordance with section 5 (4) of the Electricity Supply Act, 1919. In accordance with the provisions of this section, a further local inquiry will be held at which the National Gas Council will have every opportunity of making representations with regard to any particular clauses embodied in the draft Order.

OVERDRIVING OF METERS.

A report from the Council's Parliamentary Agents was received to the effect that gas undertakings were sufficiently protected by the Gas-Works Clauses Act of 1871. It was resolved to circulate this opinion among members of the Board for their further consideration before any action is taken.

HOME OFFICE REGULATIONS, RE CHEMICAL PROCESSES.

It was reported that clause 11 of the above regulations had been received by the Council as re-drafted by the Home Office, with the request that it be approved. The clause reads as follows:

> Every person who is exposed, to an extent injurious to health, to wet or dust from the material manipulated, or whose clothing is liable to be damaged in the course of his work by substances of an injurious or offensive character, shall be provided with suitable protective clothing, according to the nature of the work. Clothing so provided shall be maintained in good and clean condition, and shall not be removed from the works except for the purpose of being washed or repaired.

It was resolved not to approve this clause, inasmuch as such a regulation was felt to be both unnecessary and unsuitable in the case of gas-works.

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Mr. A. J. Gould, who was appointed as successor to Mr. R. Hiner, having obtained a proprietary interest in his old works (the Kington Gas-Works), has applied to be released from the management of the Ledbury Gas-Works. He remains in charge pending the arrival of his successor, Mr. A. Blakemore, of the Middlewich Gas-Works.

# CITY AND GUILDS OF LONDON EXAMINATIONS.

**List of Successful Candidates in "Gas Engineering," "Gas Supply," and "Gas-Fitting."**

THE pass-lists for the recent examinations in "Gas Engineering," "Gas Supply," and "Gas-Fitting" have been sent by the Department of Technology of the City and Guilds of London Institute to the Institution of Gas Engineers; and they have been forwarded to us for publication by Mr. W. T. Dunn, the Secretary. The questions set in the different examinations will be found in the "JOURNAL" for May 4 [p. 278], May 11 [p. 335], and May 11 [p. 336].

## GAS ENGINEERING.

**FINAL GRADE.**

**First Class.**

Allen, Frank
Blake, Thomas V.
Boulter, Lawrence W.
Brooks, John K.
Cronshaw, Oswald P.
Cunningworth, B. H.
Edmonds, F. J.
Gray, Robert
Green, Wm. G. D.
Gould, John A.
Hall, James
Hayter, Albert H.
Higton, Francis H. G.
Jack, Harold
Kendrick, Harold B.
Keillor, George E. H.
Knapman, F. G. W.
M'Sweeney, Thomas
Palmer, Lionel V.
Rose, John A.
Sainsbury, Ernest
Shaw, Eric B.
Shelley, W. J.
Sidaway, Claude C.
Taylor, Tom C.
Todd, Eric
Viggars, John C.
Withycombe, Stanley
Wright, Claude H.
Young, Alexander

**FINAL GRADE.**

**Second Class.**

Brown, Harold D.
Buchanan, M. S.
Buckley, Arnold H.
Burtles, Richard
Card, Horace
Corrigan, John
Dann, Henry N.
Day, Thomas H.
Dunbar, Harold C.
Evans, Harry L.
Foxton, John
Harris, Percy T.
Hannah, James D.
Hopkins, Frank J.
Kay, Charles
Lee, Leonard
Lewis, Richard S. B.
Mansfield, Harry O.
Martin, Arthur R.
Newton, George
Nichols, Chas. H
Ogden, John
Parrett, Jack
Phillips, Cyril J.
Read, Chas. S.
Robertson, K. J. R.
Slade, Kenneth M.
Smith, Wm. H. N.

## GAS SUPPLY.

**FINAL GRADE.**

**First Class.**

Barrett, John R.
Bradshaw, Richard J.
Callaghan, George T.
Clarke, Bernard
Collinge, Arthur K.
Gray, Robert
Keillor, George E. H.
Phillips, James W.
Preston, Joe B.
Shelley, William J.
Sidaway, Claude C.
Simpson, James
Trinder, Albert E.
Turner, Norman D.
Walker, Roland
Walkling, Arthur S.
Weaver, Leonard J.
Young, Alexander

**FINAL GRADE.**

**Second Class.**

Aston, Horace S. B.
Blake, Thomas V.
Bridgwater, Horace
Churm, Albert E.
Collyer, John C.
Cook, Alfred
Davies, Harold V.
Garrud, Thomas V.
Greenwood, Leonard
Harrison, Thomas W.
Joyce, John G.
Lister, Horace
Malyn, Leonard
Manwaring, Percy
Millington, Sherlock
Osland, Herbert J.
Pickering, Herbert W.
Rees, John T.
Roberts, John
Sainsbury, Ernest
Scott, Harold V.
Sidebottom, Alan
Stephenson, W. E.
Surman, Cyril W.
Taylor, Charles L.
Thorp, Benjamin
Treen, William C.
Turner, Dick
Ward, Dennis J.
White, Frederick H.
Wright, Claude H.

## GAS FITTING.

**FINAL GRADE.**

**First Class.**

Boyne, Alfred
Bragg, Sydney
Bullock, Walter
Chadwick, Alfred E.
Church, Arthur A.
Cliffe, Walter H.
Doyle, Vincent
Dunn, Lewis A. J.
Endicott, Richard J.
Evans, Samuel
Fox, Arthur L.
Garrud, Thomas V.
Gill, Percival W.
Highmore, Joseph
Holt, William
James, William J.
Jones, Thomas
Jones, Frederick J.
Leaman, Sidney J.
Lowton, Wilfred G.
Maddison, Thomas W.
Meek, Harry
Morton, Sydney H.
Murrin, Willie W.
Neely, William G.
Partridge, William E.
Pelling, Edgar J.
Phœnix, Robert R.
Pope, William R.
Sargent, Francis G.
Sergent, Robert
Smith, George F.
Smith William
Suckling, John R.
Trevitt, Robert
Turner, Thomas H.
Turpin, Harold D.
Wallace, Eric
White, Frederick H.
Woodward, George S.

**FINAL GRADE.**

**Second Class.**

Best, Albert R.
Bishop, Leslie W. A.
Harris, Cecil C.
Harris, Norman A. T.
Hickman, Wm. J. S.
Hobdell, John
Holroyd, John W.
Hunt, Charles J.
Kirkpatrick, J. W.
Law, Chas. V.
Muston, Frank E.
Phillips, Stanley T.
Reynolds, Fredk. I. H.
Ridgewell, Charles
Seaward, Sidney A.
Stokes, John C.
Truss, Henry W.
Williams, Claude E.

# ORGANIZATION IN THE GAS INDUSTRY.

By Sir ARTHUR DUCKHAM, K.C.B., M.Inst.C.E.

**[Reprinted, by permission of the Author, from the "Bulletin of the Society of British Gas Industries."]**

The gas meetings have been postponed. The coal strike, now happily settled, has turned what would have been for the gas industries a busy and live period into an anxious time of waiting. Times of waiting and depression are of great value nationally and individually. We have time, and are forced to take stock of our position, to discover inefficiencies, to improve methods, and to develop wider policies.

The present time is therefore very opportune to consider the organization of the gas industry. None of us can say we are satisfied with the heterogeneous collection of institutions, councils, societies, federations, &c., which exist. Discontent has been expressed within the folds of the industry, in open meeting, around the council tables of the various bodies, and over the friendly cigar and whisky and soda when members of the industry foregather. The discontent has been often voiced; but conservatism, smallness of view, and suspicion have been too strong: and what should be the most virile industry in the country is regarded by the general public as decadent, and by the Press as of minor importance when compared with our lesser sister of public utility, electricity.

It is only by the efficient development of our national resources that industrial salvation can come to this country. Coal is our chief national asset—the only practical source of heat, light, and power. Unless our coal resources are handled so that these great basic forces can be supplied to the workshop and the home at a lower cost than they can be supplied to the workshops and homes of our national competitors, our industries will leave us, our population will decrease, and England will revert to an agricultural country. The burden of putting this country on to a sound economical basis falls, in the first place, on those responsible for the provision of a cheap and plentiful supply of coal. Next comes the gas industry's burden—to take the raw material, and so treat it that the products are best adapted for the efficient supply of heat, light, and power. Surely this is a duty sufficiently important to attract and develop all that is best in us, to overcome conservatism, to stifle petty feelings.

### THE PRESENT POSITION.

Let us review our position.

We have, first, the Institution of Gas Engineers, the doyen of our societies, formed primarily for the interchange and development of technical ideas in the quiet and professional atmosphere of a council chamber. Ruled-out of these discussions is the contracting side of the industry—not because there are not among its members professional engineers of high standing and technical knowledge, but because the taint of commercialism might demoralize the proper consideration of scientific problems. Commercialism should be taboo in the Institution. But why, then, does this same Institution, and its allied societies in the Provinces, have among its members purely commercial men; and include among its activities the commercial handling of gas-works products?

The National Gas Council comes next, with its fine record worthy of its all-comprising name. But is it a National Gas Council? It represents one side of the industry. The other side is only represented through its membership of another body, the British Commercial Gas Association; and as the actual work of the National Gas Council precludes the presence of these representatives at its meetings, they are properly not admitted.

The British Commercial Gas Association is the publicity department of the industry; and well has it done its work. The name, however, is a misnomer; its duties are not commercial in the true sense. The Association is supported by contributions from both sides of the industry, and representation on the governing body is decided by the amount of the contributions. The position of the representatives of the Contractors' Society is not of the same standing as the representatives of gas undertakings; and their position is untenable.

Then comes the Federation of Gas Employers, the Gas Companies' Protection Association, &c., and, last, the Society of British Gas industries. The last-named Society was formed to bring together the contracting interests of the industry with the object of promoting the best attributes of commercial rivalry and providing a unit which could deal with the existing Institution of members of the gas profession, to lay down common and proper terms of contract, to arrive at agreed specifications of material, &c. The Society has been viewed with doubtful feelings by many members of the gas profession; it has been considered a body for the fixing of prices and the exploitation of purchasers; and its members have been looked on with suspicion as potential malpractitioners. The Society has lived to prove the unsoundness of these surmises. The bringing together of the heads of con-

tracting firms has resulted in keener and cleaner competition, the appreciation by members of each other's ideals and good points, and the repression of any suspicion of malpractice which it is realized can only bring the Society into disrepute.

To deal further and bluntly with this last point, malpractice does exist in the industry to-day. It is becoming continually less; but its existence is as much due to one side as to the other side of the industry. Certain contractors do offer or suggest considerations for the placing of contracts; certain engineers and managers ask for, or suggest, such considerations. These are the chief offenders; but only less offenders are those contractors who give when asked, and those engineers who take what is offered. It is by emphasizing the dividing line between the two sides of the industry that these unfortunate occurrences are encouraged. If the industry became one homogeneous group, it is certain the broader and sounder relationship would drive malpractice out.

### A Suggested Form of Reconstruction.

Having criticized, it becomes a duty to suggest some form of reconstruction. We must have the industry combined in one group; but within that group the various interests must be recognized and catered for. A British Gas Association should be formed, its membership comprising all members of the various recognized gas organizations. There should be a President, Chairman, and Council. The Council should be composed of representatives from each organization in the group, and would meet (say) half yearly or at such times when matters of general importance to the gas industry required consideration. All representatives on the Council would be of equal standing; and the Chairman would be appointed by a vote of the Council. The President would be chosen as the most suitable available man for the important position he would hold. It is suggested that none of the other organizations should have Presidents, but only Chairmen.

The Institution of Gas Engineers would be composed of elected members who had received an engineer's training and had served as engineers. The membership would be open to engineers employed in, or connected with, the gas industry, and would not be limited to engineers employed by gas undertakings and consulting engineers as at present.

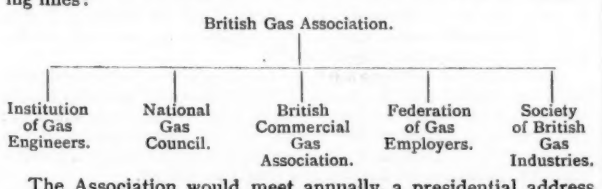
The National Gas Council would have as its members representatives of gas undertakings. The commercial work still being undertaken by the Institution of Gas Engineers would be transferred to the National Gas Council. All general commercial work of the gas undertakings would come under the Council, and it should be possible to eliminate the Gas Companies' Protection Association, and include its work in the National Gas Council's.

The British Commercial Gas Association would exist as at present; but inasmuch as it is difficult, and in fact inadvisable, for representatives from the Society of British Gas Industries to sit on the governing body, that Society would not be represented, but would meet the "B.C.G.A." for discussion on particular points as occasion might arise. The Society would still contribute to the funds of the Association.

Next comes a most important body—the Federation of Gas Employers. It is necessary that this body should be supported by the gas industry to the fullest extent; but representation of gas contracting firms on its governing body is essential. Gas contractors are engaged continuously on the works and in the districts of gas undertakings. Much trouble has occurred in the past, and is occurring now more frequently, because the contractors have wages and conditions different from those ruling in gas undertakings for the same class of work.

The Society of British Gas Industries would remain just as at present.

Thus we get an organization of the gas industry on the following lines:




The Association would meet annually, a presidential address would be given, and then the various sections would separate (for the purpose of discussion) into their various circles, on somewhat similar lines to the British Association.

The whole question requires thorough and open discussion; and all I can do in a contribution to the "Bulletin" is to open the subject afresh. I do not claim the above suggestions as my own wholly—they are the outcome of many conversations with prominent men in the gas industry.

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**Gaseous Firing for Drying China Clay.**—Mr. Thomas Settle, of Leeds, has been asked to advise Messrs. John Lovering & Co., China Clay Merchants, of St. Austell, to design for them suitable producers with the object of applying gaseous firing to the drying of china clay. We understand that Mr. Settle's double-flue control system is to be adopted; and the whole matter turns on the high cost of coal, the premier aim being the conservation of fuel resources. In these days, industries of all kinds are being driven to economize; and we should imagine that in the drying of china clay considerable fuel savings could be effected by the change from solid to gaseous fuel.

## AN INVESTIGATION OF BURNER EFFICIENCIES

### BY THE UNITED STATES BUREAU OF STANDARDS.

In connection with the last meeting of the Natural Gas Association of America, a report was submitted, entitled "How Natural Gas-Burners can be Improved," in which Messrs. I. V. Brumbaugh and G. B. Shawn gave particulars of an investigation made on behalf of the Bureau of Standards regarding the design and efficiency of such burners. Reference to matters which are dealt with in the report will be found in the "JOURNAL" for March 23 last [p. 750] and March 30 [p. 805].

It is stated in the report that the most important type of burner in domestic appliances is the top-burner of a cooking-range; and this is the type which appears to be most in need of improvement. Generally speaking, not enough primary air is injected with the gas. The burners are placed too far from the utensil, and on the average probably consume more than twice as much gas as is necessary.

It has been supposed that natural gas requires a higher gas pressure than artificial gas; and the fact that its flame is large and not so hot was supposed to be a necessary characteristic. The fact is the efficiency of natural gas burners can be compared favourably with artificial gas burners when the utensil is the same distance from the burner. Better service with natural gas and much higher efficiency can be obtained, therefore, in ranges designed for artificial gas than in the usual type of natural gas ranges which have low-set burners. With domestic burners of the present design equipped with fixed orifices, a gas pressure of less than 3 in. is usually ample to inject the air into the burner. If such a pressure were used, these burners would not require the use of an air-shutter. These results are so unexpected and so important, that it seems desirable to discuss them in some detail.

The problem is to modify the burner, the air-injector, and the gas pressure at the burner in order to get the desired proportion of primary air that will produce the right kind of gas-flame. This will result in complete combustion, much higher efficiency, more convenient operation, and good service, notwithstanding a wide variation of gas pressure in the line; and it will eliminate the readjustments of the burner. A thorough investigation of air injection has shown how to design burners and injectors to get the desired result; and, contrary to the usual belief, it has shown that, with properly designed burners, good air injection and good burner operation with natural gas can be secured with low gas pressure. A pressure at the orifice of from ½-in. to 1½ in. (averaging 1 in.), is ample to inject the primary air into the burner if the injector is properly designed.

In this investigation, eleven burners of five different types have been tested; and from the results it is possible to draw some definite conclusions concerning the relative merits of different types of burners. Much information concerning the total port area, as well as the size and spacing of ports, has been obtained. The advantages of properly-designed injecting tubes are clearly illustrated and discussed. Valuable information concerning different types of orifices has been obtained. Many tests in which the gas pressure was varied have been made to determine the pressure required for the most satisfactory operation of these different types of burners.

The natural gas used in the tests was secured from the mains of the People's Natural Gas Company, Pittsburgh. The quality fluctuates very little. For the first seven months of last year, analyses made by the Bureau of Mines averaged 89·8 p.ct. methane, 9·6 p.ct. ethane, and 0·6 p.ct. nitrogen. On the basis of this analysis, the calculated heating value is 1078 B.Th.U. per cubic foot at 30 in. of mercury and 60° Fahr.

The heating value obtained with the calorimeter averaged 1084 B.Th.U. for the period of the tests. The maximum value was 1100 B.Th.U., and the minimum 1073 B.Th.U. The specific gravity of the gas averaged 0·652.

Nearly eighty pages are occupied with the details of the tests, diagrams, &c.; but we must content ourselves with reproducing here the final remarks of the authors.

### Summary and Conclusions.

The investigation has shown that domestic appliances for use with natural gas are usually very inefficient, and that the design of the burners and method of operation can be so improved as to greatly increase the efficiency and quality of the service. The efficiency of burners of open-top stoves depends upon the distance of the utensil from the burner, the rate of consumption of gas, the design of the burner, the ratio of air to gas that enters the burner, and the distribution of the flame over the base of the utensil.

Burners of closed-top stoves were found to be from 6 to 13 p.ct. efficient when a single utensil was used and was placed immediately above the burner. By replacing the lid with an open grid, the efficiency was more than doubled; the burners being 2½ in. below the lid or grate. With the solid top removed, and the utensil placed close to the burner (1 in. is about the proper position), the efficiency of standard burners averaged about 45 p.ct., nearly four times the value with a closed top.

The rate of heating a utensil on a solid-top stove was found to be about one-half as rapid as when placed on an open grid. To

secure the same rate of heating of solid-top stoves with open-top stoves using a standard burner, would require not more than about 4500 B.Th.U. per hour (4 c.ft. per hour), in which case the burner could, in most instances, be placed about ¾ in. from the utensil, and the efficiency would be about 50 p.ct.

To secure satisfactory economy, it is necessary to have not only properly designed appliances, but also intelligent operation. Many people forget that water cannot be heated to a temperature higher than 212° Fahr. at atmospheric pressure, and that violent boiling does not accelerate a cooking operation; it only evaporates water needlessly, and wastes the gas. In many cases the burner of a large size is used, instead of a smaller one which would be just as satisfactory and much more economical. When boiling potatoes, for example, which requires the heating of water up to boiling, and thereafter to maintain boiling temperature, it should be the practice to turn the gas down when the water reaches the boiling-point, or to change to the smallest burner that will maintain boiling temperature. If this were done generally, it would do much to conserve the use of gas.

Observations of burners under various conditions of operation have shown that there are too many ports in the central part of some burners. Incomplete combustion first occurs in this region. It is very important to have the ports arranged so as evenly to distribute the flame over the base of the utensil. The ports must be spaced so that, on lighting, the flame will spread to every port. Operating burners with a high air-gas ratio as compared with a low air-gas ratio permits the spacing of the ports slightly closer together, without hindering the proper aëration of the flame.

Increasing the air-gas ratio at which a burner is operated decreases the secondary air required, and permits safe burning of a larger volume of gas under a given area; or, stated in another way, it increases the capacity of a burner, which, in turn, increases the rate at which a process can be heated. Conversely, reducing the air-gas ratio requires a larger amount of secondary air, and hence a large flame surface. Consequently, if the utensil is placed near the burner, the flame will be smothered, and the combustion will not be complete.

Careful observation of the flame at the different positions of the burner from the utensil invariably showed that, if the inner blue cone touched the utensil, carbon monoxide was produced. One can be sure, on the other hand, that no carbon monoxide will be produced if the inner blue cone is not allowed to touch the object which is being heated. However, as the cone lengthens to meet the utensil when the latter is near the burner, the distance is made approximately twice the height of the cone when burning freely. In many cases carbon monoxide was produced at positions where the distance from the burner was more than twice the height of the cone.

If there is cone-contact with the utensil, increasing the air-gas ratio from 3·1 to 7·1 decreases the rate of formation of carbon monoxide by approximately one-half. A yellow flame will produce carbon monoxide at a rate greater than a blue flame.

Formaldehyde, which has a very disagreeable odour and irritates the mucous membrane of the eyes and nostrils, is produced in very small, but objectionable, quantities by natural gas burners when the combustion is incomplete. It was observed that no odour or irritation was detected at positions of the utensil from the burner where the blue inner cone of the flame did not touch the utensil; the combustion being complete. When cone-contact occurred, the odour and irritation were much more pronounced with a flame produced by a low air-gas ratio than with one produced by a high air-gas ratio. This clearly indicates that formaldehyde and carbon monoxide are produced under similar conditions.

There is objection in winter months to the water vapour formed from the combustion of natural gas when the products of combustion are liberated into the atmosphere of the room, if the room is poorly ventilated. Since the amount of water vapour depends on the volume of gas that is consumed, increasing the efficiency of appliances, which would decrease the rate of consumption of gas, should practically remove this objection, unless the other rooms of the dwelling are heated by individual gas-heaters. The objection to water vapour from efficient natural gas appliances should not be appreciably greater than that from artificial gas appliances of equal efficiency and heat capacity. Room-heaters or other appliances consuming a very large volume of gas should always have flue connections.

### RECOMMENDATIONS.

A study of the tests warrants some definite recommendations. The service and efficiency from natural gas appliances would be greatly improved if the burners were designed, adjusted, and operated as follows:

When the gas is used for cooking, and not for room heating, the solid top of a stove should be replaced by open grids for efficient operation. By removing the solid top and raising the burner close to a grid, the efficiency will be increased approximately 400 p.ct. Instead of a standard burner in a closed-top stove, consuming about 16 c.ft. per hour (17,000 B.Th.U. per hour), as at present, the raised burner in an open-top stove, consuming about 8 c.ft. per hour (8500 B.Th.U. per hour), will heat the process in one-half the time.

*Place the Burner at a Proper Distance from the Utensil.*

Burners should be placed as close to the utensil as is possible without allowing the blue inner cone to touch the utensil. About 1 in. is the proper distance. The distance depends on the type and design of the burner, rate of consumption, and the characteristic of the flame. Carbon monoxide may be produced in quantities that may be dangerous to health, if several burners are operated at the same time in an unventilated room, if the blue inner cone of the flame is allowed to touch the utensil. Formaldehyde, which has a disagreeable odour, is also produced under the same condition.

*Increase the Port Area of the Burner.*

To ensure good service from natural gas burners, they should have about 0·08 to 0·10 sq. in. port area for each 1000 B.Th.U. consumed per hour. This will allow a greater volume of air to be injected into the burner with the gas, which will cause a shorter flame, a smaller flame volume, and a higher flame temperature, will reduce the chances for the formation of formaldehyde, and will decrease the rate of production of carbon monoxide, if the blue inner cones should touch the utensil. Therefore, the chances for complete combustion are greater with the higher air-gas ratio, which can be obtained only with the larger port area.

Design burners with proper injecting tube, with throat area having proper relation to the port area of the burner. The area of the throat of the injecting tube should be about 43 p.ct. of the total area of the burner-ports.

*A Fixed Orifice should be Used, instead of an Adjustable Orifice.*

Adjustable orifices offer an enormous amount of resistance to the flow of gas. A pressure of 2 to 3 in. is sufficient to inject the air into most of the natural gas burners now in use, and yet secure the right kind of flame, if the burners are equipped with fixed orifices. With a properly designed injecting tube, and using a fixed orifice, a line pressure of 1 in. is sufficient to inject the air into the burner and give good operation.

An air-shutter would not be necessary, if burners were designed and operated with the pressures recommended above, because natural gas does not flash-back nor light-back at the orifice. The air-shutter would be required only if an attempt is made to operate with higher pressures, so as to prevent too much air being injected into the burner, which would cause the flame to leave the ports.

*Burners should be Operated with Low Pressures.*

One of the main objections to the present low-set natural gas burners is that the service is greatly impaired if the pressure drops from 8 to 4 in., assuming that the burner was designed and adjusted for 8 in. pressure. The advantage of being able to operate an improved and raised burner designed for 1 in. pressure is that the service is not appreciably affected until the pressure drops below 0·5 in. There are three means by which low-pressure service can be obtained: (1) By individual regulators for each dwelling; (2) by district regulators; or (3) by intelligent operation of burners and careful manipulation of the gas-cock. The cost of installation of individual house-regulators will amount to a considerable sum in the aggregate, yet it might prove to be economical, and the service would be ideal because each consumer would be independent of all others. With individual regulators it is possible to convert from high pressure to low pressure as convenience dictates. District regulation of pressure is already largely in use, but not generally at a sufficiently low pressure. With this method, it is necessary to convert all burners in any one district for low-pressure operation before a change to low pressure is made. Careful manipulation of the gas-cock so as to obtain the proper volume of gas, is possible, and would be successful if all consumers would take sufficient care in operating appliances.

*Reduce the Rate of Consumption.*

When at the proper distance from the utensil, the standard burner should never consume more than about 8500 B.Th.U. per hour, which is equivalent to 8 c.ft. per hour of the quality used to make the tests reported. Gas should not be consumed at a rate which will cause the flame to extend up the side of the utensil. This is extremely wasteful.

If natural gas burners used in cooking stoves were designed, adjusted, and operated according to the recommendations herein outlined, they would be from two to four times more efficient; the present demand of the public for an improvement in the service would be satisfied; and one phase of the demand for the efficient utilization of natural gas would be solved.

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**Rivet-Heating by Gas.**—A great deal of useful information upon the important subject of rivet-heating in shipyards, &c., is given (with a number of copyright illustrations) in No. 89 of "A Thousand-and-One Uses for Gas," issued by the British Commercial Gas Association, at the price of 6d., post free. Mr. Letson Balliet, of San Francisco, emphasizes the many advantages which gas possesses for this work, and states that the rivet-heaters drive from 20 to 30 p.ct. more rivets in eight hours with the new gas rivet-heating furnaces than they did when they used appliances heated by solid fuel. There are also particulars and photographs of rivet-heating furnaces employed in a large engineering works at Darlington, by the installation of which, in place of a solid-fuel furnace, the fuel cost for heating 800 ¾-in. rivets at the rate of 100 per hour was reduced from 6s. 3d. to 2s. 9½d. The price of solid fuel is taken at 2s. per cwt., and of gas at 2s. 6d. per 1000 c.ft. At the same time, the floor-space required for the furnace was brought down from 3240 sq. in. to 672 sq. in., and the space formerly needed for coal and ash stacks was rendered available for other purposes.

# REPORT OF THE REFRACTORY MATERIALS RESEARCH COMMITTEE TO THE INSTITUTION OF GAS ENGINEERS.

By Dr. L. BRADSHAW and Mr. W. EMERY.

THE following report of the Refractory Materials Research Committee was prepared by Dr. L. Bradshaw and Mr. W. Emery for submission to the annual meeting of the Institution of Gas Engineers. Some of the photographic illustrations by which the report is accompanied are not reproduced.

## NOTES ON JOINTING MATERIALS FOR REFRACTORIES.

### I.—THE SOFTENING-POINT OF MIXTURES OF SILICA BRICK AND CLAY FIREBRICK.

In general, the jointing material used for laying fireclay bricks consists of a mixture of ground raw clay and grog, with or without sand; while for silica bricks, crushed silica with a small proportion of fireclay is employed. It is well known that the softening temperature of silica-fireclay mixture is lower than that of either constituent. Where the reduction of refractoriness is only slight, it may be an advantage, as, for instance, in cases where the partial vitrification of the jointing material strengthens its binding power; but beyond a certain point, any increase in the fusibility of the bond is undesirable. It is, therefore, important to determine experimentally to what extent the softening-point of fireclays is affected by the addition of increasing quantities of siliceous material, or *vice versa*; and the need for such data has been suggested to us by Dr. J. W. Mellor. Seger has constructed a curve showing the fusion-points of pure silica mixed with pure alumina, and with kaolin. The present experiments relate to mixtures of crushed silica brick with fireclay brick.

The materials, after grinding, were found by analysis to have the following chemical composition and grain size:

TABLE I.—*Chemical Analysis and Grain Size.*

| — | Silica Brick. | Fireclay Brick. |
|---|---|---|
| $SiO_2$ | 96·02 | 56·78 |
| $TiO_2$ | Trace | 1·38 |
| $Al_2O_3$ | 0·96 | 37·35 |
| $Fe_2O_3$ | 0·79 | 2·37 |
| MnO | — | — |
| MgO | 0·11 | Trace |
| CaO | 1·18 | 0·74 |
| $K_2O$ | 0·26 | 0·60 |
| $Na_2O$ | 0·26 | 0·68 |
| Loss on ignition | 0·20 | 0·38 |
| Through 200's lawn | 99 p.ct. | 82 p.ct. |

It will be observed that practically the whole of the silica and over 80 p.ct. of the fireclay pass through a 200's lawn. This degree of fineness is sufficient to ensure an intimate admixture of the two substances.

The mixture was formed into cones of suitable size, and the refractoriness determined in the usual way in an electrically heated furnace. As a check upon the results, three or four of the test-pieces in sequence were mounted on the same base and heated together, whereby an indication of their relative order of softening was obtained, apart from the reading of the Seger cones adjacent to them. The results are reproduced in Table II., and plotted in the curves.

TABLE II.—*Normal Refractoriness of Mixtures of Fireclay Brick with Silica Brick.*

| No. | Fireclay Brick. | Silica Brick. | Normal Refractoriness Seger Cone. |
|---|---|---|---|
| 1 | 100 | .. | 33 |
| 2 | 80 | 20 | 31 |
| 3 | 70 | 30 | 30 |
| 4 | 60 | 40 | 28 |
| 5 | 50 | 50 | 20-26 |
| 6 | 45 | 55 | 19-20, nearer 20 |
| 7 | 40 | 60 | 19-20 |
| 8 | 35 | 65 | 20, softer than No. 9. |
| 9 | 30 | 70 | 20 |
| 10 | 25 | 75 | 20-26 |
| 11 | 20 | 80 | 26-27 |
| 12 | 15 | 85 | 28-29 |
| 13 | 10 | 90 | 30 |
| 14 | .. | 100 | 31 |

It will be seen that the addition of a small amount of fireclay to silica brick produces a greater effect than a corresponding amount of silica brick added to fireclay brick. Thus, the addition of 25 p.ct. of fireclay to silica brick (Experiment 11) reduces the refractoriness by 4½ cones, and of about 43 p.ct. (Experiment 9) by 6 cones; while the addition of these amounts of silica brick to fireclay brick (Experiment 2 or 3) produces differences of 2 cones and 3 cones respectively. The eutectic mixture, which softens at Seger cone 19-20, has the composition 15·01 p.ct. $Al_2O_3$, 80·32 p.ct. $SiO_2$—corresponding to 1 molecule $Al_2O_3$, 9 molecules $SiO_2$. For pure kaolin and silica mixtures, Seger obtained an eutectic having the approximate composition 1 $Al_2O_3$: 17$SiO_2$, which softened at cone 26. It should be noted, however, that the silica and fireclay bricks contain bases, by which the eutectic point is greatly influenced.

The general form of the curve (fig. 1) corresponds to that obtained by Seger.

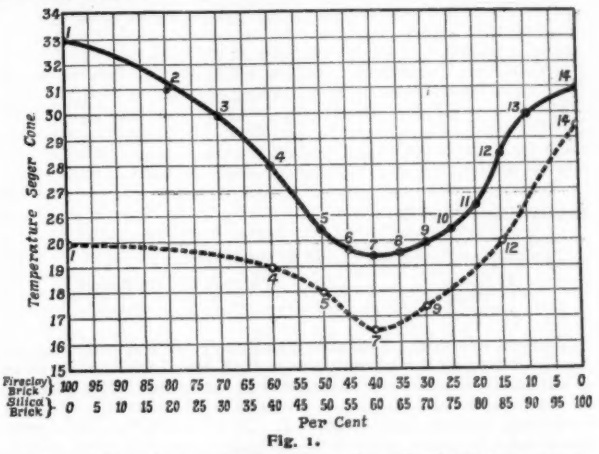


Fig. 1.

A few of the above mixtures were also submitted to a refractory test under load; and results were obtained as shown in Table III. These results are plotted in the broken curve (fig. 1). The values fall into the same order as those of the ordinary refractoriness; but the curve is steeper on the silica side and flatter on the fireclay side—*i.e.*, the differences between the softening temperatures with and without load are less in the case of siliceous mixtures than for mixtures rich in fireclay, thus confirming the results obtained by Mellor, Moore, and Emery.

TABLE III.—*Refractoriness under Load of Mixtures of Fireclay Brick with Silica Brick.*

| No. | Fireclay Brick. | Silica Brick. | Refractoriness under Load 35 Lbs. per Sq. In. |
|---|---|---|---|
| 1 | 100 | .. | 20 |
| 4 | 60 | 40 | 19 |
| 5 | 50 | 50 | 18 |
| 7 | 40 | 60 | 16-17 |
| 9 | 30 | 70 | 17-18 |
| 12 | 15 | 85 | 20 |
| 14 | .. | 100 | 29-30 |

When coarser-grained mixtures are substituted for those used in the foregoing experiments, the effect upon the softening-point is less marked. Thus the softening-point of a mixture consisting of equal parts of fireclay (normal refractoriness cone 33) and building sand (normal refractoriness cone 32) was found to be cone 30-31; and those of mixtures containing 33·3 p.ct. and 80 p.ct. of the same sand, cones 30 and 29 respectively. The grain sizes and chemical composition of the clay and sand are shown in Table IV.

TABLE IV.—*Chemical Analysis and Grain Size of the Fireclay and Building Sand.*

| — | Fireclay. | Building Sand. |
|---|---|---|
| $SiO_2$ | 49·72 | 87·12 |
| $TiO_2$ | 1·21 | 0·19 |
| $Al_2O_3$ | 32·72 | 5·18 |
| $Fe_2O_3$ | 2·07 | 2·03 |
| MnO | — | — |
| MgO | trace | 0·02 |
| CaO | 0·63 | 1·30 |
| $K_2O$ | 0·52 | 2·04 |
| $Na_2O$ | 0·57 | 0·8 |
| Loss on ignition | 12·66 | 1·34 |
| Residue on 20's mesh | — | 10·5 |
| Through 20's on 40's | 33·3 | 23·0 |
| ,, 40's on 80's | 33·3 | 54·2 |
| ,, 80's | 33·3 | 12·3 |

In this case, the cones were made-up with raw fireclay, and tested after firing once at a low temperature. It is probable, however, that the softening-point of the coarser mixtures would be further reduced in actual use, owing to the gradual disintegration of the silica grains.

## II.—Mixtures of Fireclay with Fireclay Grog.

In the preparation of mortars for fireclay bricks, the addition of grog to fireclay is a general practice. Grog is added to lessen the shrinkage of the clay. On the other hand, it reduces the binding power and mechanical strength; and the mixture is more difficult to spread. The grading and proportioning of the materials used are of prime importance; but these factors do not appear to have received much attention.

In the following experiments, the effects of mixing carefully graded materials in various proportions have been studied. The materials employed had the following composition:

Table V.—*Chemical Analysis of Fireclay and Grog.*

| — | Raw Fireclay. | Grog. |
|---|---|---|
| $SiO_2$ | 49·72 | 56·76 |
| $TiO_2$ | 1·21 | 1·38 |
| $Al_2O_3$ | 32·72 | 37·35 |
| $Fe_2O_3$ | 2·07 | 2·37 |
| MnO | — | — |
| MgO | trace | trace |
| CaO | 0·63 | 0·74 |
| $K_2O$ | 0·52 | 0·60 |
| $Na_2O$ | 0·58 | 0·68 |
| Loss on ignition | 12·66 | 0·38 |
| Refractoriness, Seger Cone | 33 | 33 |

The clay and grog were used in three grades:

(*a*) Coarse . . . . . Through 20's mesh on 40's
(*b*) Medium . . . . . ,, 40's ,, 80's
(*c*) Fine . . . . . ,, 80's ,,

The wet mixtures, of suitable consistency, were spread between a pair of fireclay bricks, which were then keyed together by slabs of the same material let into grooves in the ends. After allowing to dry for several days, they were fired in an industrial kiln at a maximum temperature of cone 8. In all cases the joints were practically of equal thickness. When the material has a high contraction, cracks develop during the air-drying; while in other cases they appear only after firing. These cracks are invariably transverse—*i.e.*, across the joint—owing to the shrinkage along its length. Longitudinal cracks generally do not appear.

The method adopted for locking the bricks has the disadvantage that the upper brick is prevented from sinking as the mortar contracts, as it would do if built into masonry; and for this reason a fine parting is sometimes observed along the face of the brick. Since, however, certain mixtures possess very little binding power, the bricks in such cases tend to fall away when they are turned on edge for the sag penetration tests; and some method of holding them together is essential. This fact should be borne in mind in examining the data obtained in the slag penetration tests. The longitudinal parting, which is often so fine as to escape detection except under a magnifying glass, would probably not occur in bricks built into columns and free to settle under their own weight.

For the measurement of contraction and resistance to crushing, the mixtures were formed into briquettes. The examination of the material in mass in this way affords useful information as to the relative proportions of the various mixtures; but the data thus obtained are not a safe criterion of the suitability of such mixtures for jointing purposes, except in so far as they are used in conjunction with other observations. A briquette of fine clay, for example, forms a hard compact mass free from cracks, which offers very high resistance to crushing and slag penetration. The same clay, after firing between bricks, exhibits large fissures into which slag can penetrate freely. The use of briquettes in the slag penetration test, however, is essential, as it affords the only means of determining the penetration into the material proper, as distinct from the flow of the slag into cracks. This test is described in the Appendix. The results obtained are collected in Table VI. The sharp increase in the contraction of the clay with diminishhing grain size is clearly shown, as also the corresponding increase in mechanical strength;* and the resistance to slag penetration (Experiments 1, 2, and 3).

The addition of 50 p.ct. of grog of the same grade (Experiments 4, 8, and 12) largely reduces the contraction, and allows a greater penetration of slag. Differences of the same kind, but of less magnitude, are obtained by the use of only 33 p.ct. of grog (Experiments 16 and 13). The effects of a larger proportion of grog are shown in Experiments 20 and 17.

Other experiments show the effects of mixing different grades of clay and grog. A briquette of fine clay with coarse grog (Experiment 6) has a much greater contraction and crushing strength, and suffers less slag penetration in the mass than a mixture of coarse clay with fine grog (Experiment 10). While mixture No. 10 is friable, No. 6 is firm; this being due to the binding power of the clay between the grog particles.

The influence of fine clay on the wet-to-dry shrinkage is very marked (Experiments 6, 9, and 12). In comparing these experiments, it may be noticed that the values obtained differ but slightly, and that the effect of increasing the grain size of the grog is not clearly brought out. In reality the differences are probably somewhat greater; but they are masked by experimental error, due to the difficulty of making accurate measurements of the contraction of the coarser-grained mixtures. Errors of at least 0·5 p.ct. may be expected. Taken as approximations, however, the figures give a satisfactory indication of the general effects.

Of the mixtures examined, those composed of mixed grades of clay and grog (Nos. 22 and 23) appear to give the best results. These mixtures are mechanically strong, have a sufficiently small contraction, and set between bricks to a hard, compact mass, which is free from cracks and is not easily attacked by molten slags. They might probably be improved by omitting the coarse grade of clay and grog, and would be worth examining in greater detail. No. 24, in which the proportion of clay is increased, is not so good.

The effect of substituting ungraded building sand (for analysis, see Table VII.) for grog, is shown in Nos. 25 and 26, which are generally inferior to Nos. 22 and 23. The addition of sand diminishes the fire-shrinkage, but renders the mixture friable. It seems likely, however, that the addition of a small proportion of fine silica to mixtures of clay and grog would be beneficial for several reasons. Experiments upon these lines will form the subject of a later report.

* For the effect of grain size on crushing-strength, see J. W. Mellor and W. Emery, "JOURNAL," Vol. CXLVI., p. 619.

Table VI.

| Experiment No. | Composition. Fireclay. Coarse. | Fireclay. Medium | Fireclay. Fine. | Grog. Coarse. | Grog. Medium. | Grog. Fine. | Contraction. Wet to Dry. P.Ct. | Dry to Fired. P.Ct. | Total. | Crushing Strength of Briquettes, Lbs. per Sq. In. | Relative Slag Penetration. * No. 3 = Unit. Briquettes. | Joints. | Observations on Jointing Material after Firing. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | – | – | – | – | – | 2·0 | 4·5 | 6·5 | 830 | 26 | In cracks | Very friable, fine transverse cracks. |
| 2 | – | 1 | – | – | – | – | 7·5 | 5·8 | 13·0 | 6,000 | 4 | Along parting | Friable, free from cracks, fine longitudinal parting. |
| 3 | – | – | 1 | – | – | – | 10·5 | 6·7 | 16·5 | 13,600 | 1* | In cracks | Very hard, large transverse cracks. |
| 4 | 1 | – | – | 1 | – | – | None | — | — | <400 | 30 | 40 and along parting | Friable, free from cracks, fine parting. |
| 5 | – | 1 | – | 1 | – | – | 1·0 | 1·0 | 2·0 | 1,070 | 20 | 12 | ,, ,, ,, ,, |
| 6 | – | – | 1 | 1 | – | – | 5·0 | 1·0 | 6·0 | 3,200 | 8 | In cracks | Firm, fine local cracks. |
| 7 | 1 | – | – | – | 1 | – | 0·5 | 0·5 | 1·0 | <400 | 28 | 32 | Very friable, free from cracks. |
| 8 | – | 1 | – | – | 1 | – | 2·5 | 1·5 | 4·0 | 1,280 | 12 | 22 | Firm, free from cracks. |
| 9 | – | – | 1 | – | 1 | – | 5·0 | 1·0 | 6·0 | 3,500 | 5 | In cracks | Firm and hard, fine local cracks. |
| 10 | 1 | – | – | – | – | 1 | 1·5 | 0·5 | 2·0 | 730 | 16 | 16 | Friable, free from cracks. |
| 11 | – | 1 | – | – | – | 1 | 2·0 | 1·0 | 3·0 | 1,800 | 9 | 9 and in cracks | Firm, a few local cracks, fine parting. |
| 12 | – | – | 1 | – | – | 1 | 5·5 | 1·0 | 6·5 | ? 3,500 | 6 | 12 and in cracks | Firm and hard, extensive fine cracks, fine parting. |
| 13 | – | – | 2 | – | – | 1 | 5·5 | 2·0 | 7·5 | 5,210 | 5 | 8 and in cracks | ,, ,, ,, large transverse cracks. |
| 14 | – | 2 | – | – | – | 1 | 3·5 | 2·0 | 5·5 | 2,860 | 6 | 6 and in cracks | ,, ,, ,, ,, ,, ,, better than 13. |
| 15 | – | – | 2 | – | 1 | – | 5·5 | 2·0 | 7·5 | 6,630 | 6 | — | Firm, very hard, large transverse cracks. |
| 16 | – | 2 | – | – | 1 | – | 3·5 | 1·7 | 5·2 | 2,200 | 7 | 8 | Firm, hard, free from cracks. |
| 17 | – | – | 1 | – | – | 2 | 3·0 | 1·2 | 4·2 | 2,960 | 2 | 6 and in cracks | Firm, a few transverse cracks. |
| 18 | – | 1 | – | – | – | 2 | 2·5 | 1·0 | 3·5 | 1,710 | 4 | 8 and in parting | Firm, less hard than 17, free from cracks, fine parting. |
| 19 | – | – | 1 | – | 2 | – | 3·0 | 1·0 | 4·0 | 3,070 | 6 | 6 | Firm and hard, free from cracks. |
| 20 | – | 1 | – | – | 2 | – | 2·5 | 0·9 | 3·4 | <800 | 10 | 10 | ,, ,, ,, ,, ,, ,, |
| 21 | – | – | 1 | – | – | 3 | 2·9 | 1·1 | 4·0 | 2,730 | 8 | 10 and in cracks | Firm, fine transverse cracks. |
| 22 | 1 | 1 | 1 | 1 | 1 | 1 | 3·1 | 0·9 | 4·0 | 2,230 | 7 | 6 and in parting | Very hard, free from cracks, slight parting. |
| 23 | 1 | 1 | 1 | 2 | 2 | 2 | 2·0 | 0·2 | 2·2 | 1,560 | 8 | 8 and in parting | ,, ,, ,, ,, ,, ,, |
| 24 | 2 | 2 | 2 | 1 | 1 | 1 | 5·5 | 1·0 | 6·5 | 2,500 | 8 | 8 and in parting | Firm and hard, moderate transverse cracks. |
| | | | | Sand Ungraded. | | | | | | | | | |
| 25 | 1 | 1 | 1 | 3 | | | 4·9 | 0·6 | 5·5 | 1,300 | 10 | 16 | Soft and friable, free from cracks. |
| 26 | 2 | 2 | 2 | 3 | | | 6·3 | 1·0 | 7·3 | 2,170 | 9 | 10 and in cracks | ,, ,, ,, moderate transverse cracks. |

TABLE VII.—*Chemical and Mechanical Analysis of the Building Sand.*

| | |
|---|---|
| $SiO_2$ | 87·12 |
| $TiO_2$ | 0·19 |
| $Al_2O_3$ | 5·18 |
| $Fe_2O_3$ | 2·03 |
| MnO | — |
| MgO | 0·02 |
| CaO | 1·30 |
| $K_2O$ | 2·04 |
| $Na_2O$ | 0·8 |
| Loss on ignition | 1·34 |
| Residue on 20's mesh | 10·5 |
| Through 20's on 40's | 23·0 |
| ,, 40's on 80's | 54·2 |
| ,, 80's | 12·3 |

It is evident that the preparation of a suitable mortar is mainly a question of balancing the opposing qualities of its constituents. Fine clay alone, in mass, is not readily affected by corrosive slag; but in joints, owing to the extensive cracking, the slag penetrates deeply into the network of fissures, whereby a much larger area of material is laid open to attack. The addition of grog reduces the shrinkage and cracking, but increases the porosity and decreases the mechanical strength of the material, and so on.

The influence of the addition to fireclay of various substances, such as portland cement, lime, asbestos, sodium silicate, carborundum, &c., has been studied by R. M. Howe.*

APPENDIX.

The slag penetration test is based upon that of Messrs. Nesbitt and Bell. A rectangular porcelain trough 1¼ in. in depth is placed horizontally over the joint, and cemented to the bricks. It is then filled with a mixture of a fusible, corrosive mixture. On heating to a high temperature, the slag attacks the jointing material, and generally also the brick. The amount of penetration will obviously depend upon the specific corrosive power of the mixture employed, as also upon the duration of heating and the temperature.

The results obtained by this method are merely comparative. In the experiments recorded above, the penetration into fine clay (No. 3) is taken as unity, and the other values represent the average depth of penetration—not the area, which is sometimes taken. When the material develops cracks, the penetration into the substance proper is frequently obscured by the flow of slag through the cracks. In any case, it is difficult to measure the penetration with accuracy; and the values given are intended merely to serve as a rough guide.

The mixture in the trough had the following composition: Litharge, 43 p.ct.; sodium carbonate, 40 p.ct.; sodium fluosilicate, 13 p.ct.; and ferric oxide, 4 p.ct.

## THE INFLUENCE OF OXIDIZING AND REDUCING ATMOSPHERES ON REFRACTORY MATERIALS.

### PART I.—THE BEHAVIOUR OF CLAY PYROSCOPES AND FIRECLAY BRICKS IN COAL GAS.

During the course of some experiments in which pyrometric cones, used to indicate the temperature of refractory test-pieces heated electrically in a tube furnace, were exposed to a current of coal gas, we observed that the cones remained erect at temperatures far above their normal softening-points. On subsequent examination, some of these cones were found to consist merely of a hollow shell with a quantity of slag discharged at the base, or of a semi-vitrified mass covered with an infusible skin. The outer shell is extremely refractory. In view of the fact that, under works' conditions, pyrometric cones are frequently exposed to reducing atmospheres of coal gas and air, the closer investigation of their behaviour in such circumstances appeared to be of interest, since any irregularity would vitiate the conclusions deduced from the cone data.

The cones may be conveniently examined in groups. R. Rieke studied the effect of heating Seger cones 022-15 under various conditions in air. He found that the melting-points of all these cones are influenced by the rate and duration of heating—thus confirming the earlier observation of J. W. Mellor that time and atmosphere are essential factors in the action of heat on Seger cones. Cones 022 to about 013*a* melt at a lower temperature if the rate of heating is slow—in consequence of their relatively high content of easily fusible frit—while cones 012*a* to 1*a* show the reverse effect, in that, on prolonged heating, they undergo a sort of devitrification on the surface, whereby a more refractory skin is formed which supports the whole mass. The formation of this skin is attributed to various causes, such as: (1) The production of refractory silicates (or alumino-silicates) by the gradual interaction of the individual constituents. (2) The partial escape of the more volatile constituents on prolonged heating. Boric acid and the alkali borates especially tend to volatize; the effect of this being to lower the proportion of fritting substance in the surface layer, and thus to produce a less fusible shell on the outside of the cone. (3) The oxides present in the cone-mixture (especially ferric oxide contained in cones 010-1) may, under the solvent action of the boric acid, form large crystals, which react but slowly with the mass.

Rieke submitted cones 08*a*-1*a* to a prolonged heating in a porcelain furnace at cone 09*a*. After this treatment, the cones exhibited a matt, devitrified surface. On heating them beside the corresponding original cones in an experimental electric furnace, it was found that the treated cones retained their sharp edges and matt appearance after bending, while the others have a smooth surface and rounded edges. The softening-point of the treated cones was 15° to 40° C. higher than that of the original cones. Further Rieke found that the range of cones 2*a* to 17 soften at a lower temperature on protracted heating than on rapid heating. Cones 6-9 exhibited differences amounting to as much as 80° to 100° C. This is supposed to be due to the high viscosity of the vitrified mass by which the bending is retarded.

The effects which we have obtained by heating Seger cones in coal gas cannot be accounted for by any of these explanations, since they are observed not only in the lower cones containing borax frit, but also in the higher ranges of cones which are free from borax and other volatile matter. Moreover, the rate of heating adopted in these experiments is comparatively rapid—generally approximating to 10° C. per minute.

C. Loeser compared the behaviour of Seger cones in oxidizing and in reducing atmospheres, and noted important differences in the appearance of the residues. Cones 021-016, on heating to a sufficiently high temperature in an oxidizing atmosphere, melted-down to a smooth glass containing black specks of organic matter, while in a reducing atmosphere the residues consisted of sharply pointed pyramids of uniform deep colour or black throughout. He remarks: "Since we cannot assume that the composition of the lower portion and the interior of these cones originally differed from that of the tip and the outer coat, this appearance can only be explained by supposing that the relatively higher rate of heating in the reducing atmosphere brings about a partial separation of the constituents, the more fusible portion running out." We shall return to this point later. Many years ago, a writer in the "British Clayworker" called attention to the abnormal behaviour of cones (apparently in a brick kiln). Despite the usual precautions taken to protect them from the direct flame and dust, "what appeared to be a perfect cone, looked at through the inspection-hole, has turned out to be nothing but the shell of a cone, the inside having fused and run-out at the bottom." Our experiments have shown that this is the normal behaviour of a wide range of Seger cones* when heated in coal gas, or in mixtures of coal gas with a limited amount of air, to a temperature well above their ordinary softening-points. It appears to be due to the formation of a thin film of hard carbon in intimate contact with the surface of the cone.

Bone and Coward, who investigated the thermal decomposition of a number of hydrocarbons, found that this variety of carbon is produced by the decomposition of methane. "The carbon deposited from methane is of a peculiarly hard and lustrous type, wholly different from the dull and soft variety yielded by the other three hydrocarbons (ethane, ethylene, and acetylene), except in so far as part of the latter may arise as a result of the secondary decomposition of the other hydrocarbons mentioned." Since all these hydrocarbons may be present in coal gas, their mode of decomposition on heating has an important bearing on our subject. Bone and Coward showed that not only is methane the most stable of the above-named hydrocarbons, but it is always a principal product of the decomposition of the other three—especially at temperatures above 800° C. Methane itself decomposes for the most part directly into carbon and hydrogen. The process of decomposition was found to differ from those of the other hydrocarbons in that it is wholly a surface effect; the carbon being deposited on the walls of the furnace-tube and the fragments of unglazed porcelain packing, in the lustrous metallic form already referred to. Methane remains practically unchanged up to about 800° C. Between 800° and 1000° C. it decomposes slowly, but only in contact with hot surfaces. Above 1000° C. its decomposition, while still entirely a surface effect, is more rapid.

In the case of the other three hydrocarbons, decomposition takes place throughout the entire body of the gas, and proceeds rapidly at temperatures above 800° C. For this reason, coal gas generated in retorts where the coal is carbonized at temperatures of 800° C. and upwards contains comparatively little ethylene and and ethane, and practically no acetylene. The coal gas used in the experiments described below contains approximately 32 p.ct. of methane, and less than 2 p.ct. of other hydrocarbons. Both types of carbon are obtained; but the lustrous variety predominates, and appears to be the main cause of the increased refractoriness of the cones. In the case of cones which do not soften below about 1000° C., the temperature of the furnace can be raised to upwards of 800° C. before admitting the coal gas. Under these conditions, an inappreciable amount of soft carbon is deposited, and the surface of the cones exhibits a beautiful metallic lustre. A similar effect is obtained when pure methane is substituted for coal gas.

The apparatus employed is an electrically heated tube-furnace of the Hirsch type, consisting of a central vertical tube of highly refractory material within an outer case of fireclay; the space between the two being filled with powdered graphite. The

* See "JOURNAL," Vol. CXLIX., p. 366.

* The cones used in these experiments are of English manufacture. Similar results were obtained with some cones of German origin supplied by Seger and Cramer, of Berlin.

current passes between a pair of ring electrodes placed top and bottom of the graphite column. For the purpose of these experiments, we introduced a slight modification, which we have found convenient in the general investigation of the action of gases on refractory materials at high temperatures. This consists of a second cylindrical tube placed co-axially within the first. In the ordinary single-tube furnace, a considerable amount of carbon monoxide is usually formed from the oxidation of the graphite by air diffusing through the porous walls of the tube. This can be greatly diminished by the arrangement of double tubes. The space between the tubes is swept-out with a current of inert gas (such as nitrogen), while the test-piece is exposed in the inner tube to an atmosphere relatively free from impurities. The gases enter through two nozzles screwed into a water-cooled plate which forms an air-tight joint at the bottom of the furnace. In the present case two independent currents of coal gas are used. It should be observed that the coal gas is in no way intended for the heating of the furnace.

The appearance of some of the cones taken from the furnace is shown in fig. 2. The superficial crust is plainly distinguishable in

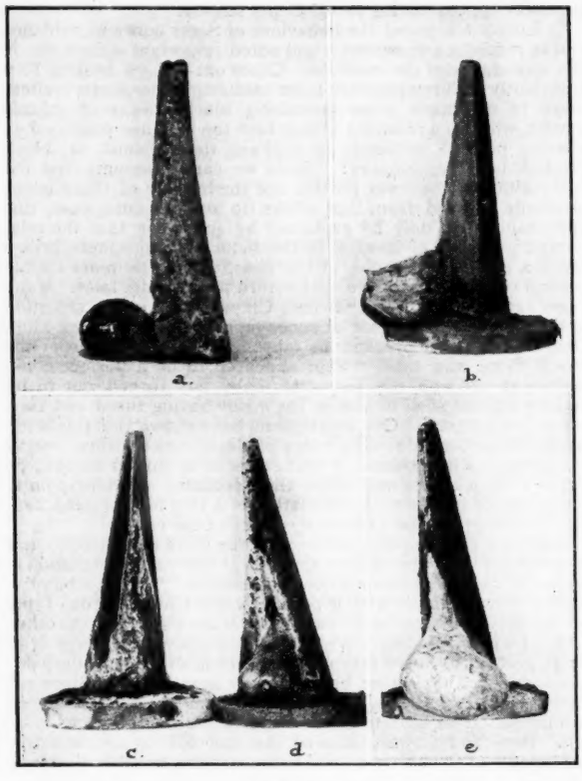


Fig. 2.

(*c*), where it is seen split down the edge and forced outwards by the slag. The heating was interrupted at this stage. In (*d*) is shown the effect of further heating on a similar cone. In (*e*) the slag has been discharged at a weak spot on the face of the cone. The lustrous grey shell is best observed in (*a*). All these specimens were prepared from cone 10 (normal softening-point about 1300° C.).

A large number of cones having different softening-points were tested; and the same effects were noted in the more refractory cones. In the downward direction, as might be expected, a limit is reached approximately at the temperature at which the decomposition of methane almost ceases. A firm, refractory shell can be produced with certainty down to about 950° C. (cone 08*a*). Below this temperature, the results become erratic; while lower still, the cones are only slightly affected. The softening-points of the low cones are raised slightly above the normal, and the residues are found to be impregnated with carbon. This offers a probable explanation of the refractory stumps obtained by Loeser in the experiment already referred to, where a slight excess of coal gas was present.

The carbon is not confined to the surface of the cones, but is found in the pore spaces throughout the mass. Cones ordinarily contain traces of organic matter from the binding substances used in their preparation; but this may be completely removed by gentle ignition in air. A micro-section* through a cone ignited in this way, and then heated in coal gas for a few minutes at about 1000° C., shows the cavities lined or completely blocked-up with carbon. There is no evidence of the formation of carbides. Carbon is also found enclosed in the slag from the interior of the cone, but in insufficient quantity to produce a very marked elevation of the softening-point.

It has been found possible, by a simple arrangement, to drain-off the slag from the interior, leaving the outer shell intact. The cone is mounted over a hole of suitable size bored through a thin refractory plate, which forms the lid of a hollow cylinder of the same material. On heating in a current of coal gas to a temperature considerably above the normal softening-point of the cone, the viscous material is discharged into the receptacle below, while the refractory shell remains standing and appears from the outside unaltered.

* We are indebted to Dr. A. Scott for preparing the micro-sections.

## Note on the Behaviour of Fireclay Brick in Coal Gas.

A few experiments were made with a test-piece of fireclay brick, heated in an atmosphere of coal gas under the conditions already described. The surface deposition of hard carbon is also observed in this case; but the temperature attained in the furnace in general is not sufficiently high to reduce the clay material to a mobile slag.

Test-pieces prepared from fireclay mixed with a small percentage of ferruginous marl, by which the softening-point is lowered, behave similarly to cones, the slag bursting through the coating of carbon. This is illustrated in fig. 3. In (*a*) is shown the slag partially discharged through two vertical cracks; in (*b*) the shell has been broken at the top to show the hollow space beneath.

The idea of a protective coating of hard carbon artificially produced on fireclay surfaces might possibly be utilized in gas-works practice.

## Note by the Director, Dr. J. W. Mellor.

There are many features about the action of reducing gases on ferruginous clays which have puzzled me for many years. I thought that it would be well, therefore, to start from the beginning and commence with clays as free from combined iron as nature has supplied. Seger cones offered convenient mixtures for this purpose.

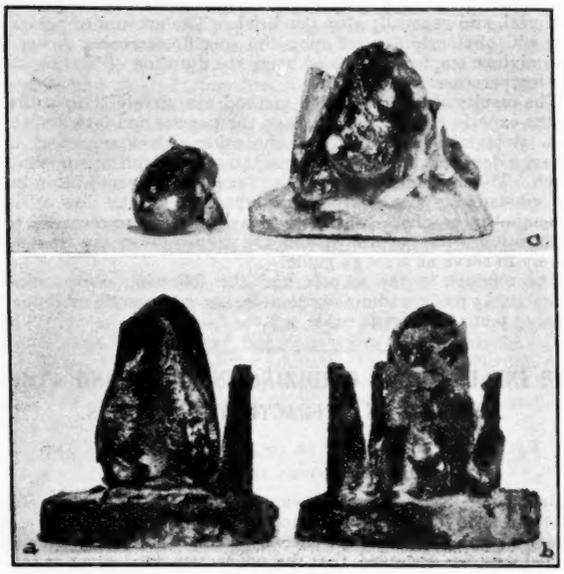


Fig. 3.—Full Size.

The experimental result indicated in fig. 3 is extraordinary; and the experiment itself is ingenious. There are some important lessons to be learned from the results here set-forth.

(1) The fusibility of the mixture itself is not much affected by the reducing atmosphere *per se*.

(2) In the presence of hydrocarbons, the gas decomposes, and deposits a hard variety of carbon in the shell. This is a totally different thing from the result claimed in the patent by R. Lessing, No. 12,119, of 1911.

The carbon deposited in Dr. Bradshaw's and Mr. Emery's work is not the ordinary smoke variety, but is of a hard, presumably graphitic form. The graphitic carbon is also more intimately associated with the clay when deposited by the decomposition of the gas than when a mixture of clay and graphite is used as a refractory.

At present the imparted refractoriness is a surface effect; but the refractoriness of the shell is so very much higher than that of the untreated material that, if the fact can be applied practically, it should be possible to make a super-refractory from the purer clays (and with bricks also from ordinary fireclays). Even if we succeeded in thus augmenting the refractoriness of the bricks in a practical way, we should be far from a complete solution, because the imparted refractoriness might not endure under working conditions. It is therefore best to drop speculations, and try.

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The postponed annual general meeting of the Scottish Junior Gas Association (Eastern District) will be held on Saturday afternoon, in the Heriot-Watt College, Edinburgh, when the President (Mr. D. Campbell, of Anstruther) will deliver his address. Mr. J. W. M'Lusky will also address the members.

# OXIDATION OF AMMONIACAL LIQUOR BY AIR.

**[From the Report for 1920 of Dr. T. Lewis Bailey, Chief Inspector under the Alkali Works Regulation Act.]**

### OXIDATION OF AMMONIACAL LIQUOR BY AIR.

Attention was first directed in the laboratory of the Chief Inspector's under the Alkali Works Regulation Act to the effect of aeration on ammoniacal liquors in 1898. The then Chief Inspector, Mr. Forbes Carpenter, was unwearied in his efforts to lessen the work thrown upon oxide purifiers attached to sulphate of ammonia works, by preliminary treatment of the liquor to effect oxidation of the sulphide to thiosulphate. A laboratory investigation was undertaken at his direction, to determine the conditions most favourable for oxidation; while later the laboratory tests were extended to include experiments on a limited working scale at one of the Scottish gas-works, and a complete set of data was obtained for translation of the small-scale operations into a large-scale unit. Expectations, however, were not realized. The trial working of the larger unit in the hands of the works chemist indicated that the rate of oxidation of ammonium sulphide to thiosulphate proceeds too slowly, even under the most favourable conditions, to render it commercially practicable to go on with an extension of the process; and the experiments were discontinued. Mr. Curphey also devoted much time and thought to the same problem; but no practicable process could be devised for speeding-up the reactions.

In 1917, difficulties experienced at one of the gas-works through repeated blockage of the still by deposited sulphur caused attention to be re-directed to the effect of aëration on ammoniacal liquor circulated on the scrubbers of gas-works, and more particularly to its effect in reducing the amount of volatile cyanide in the liquors, and indirectly in the crude coal gas entering the purifiers. It was suggested that relief might be sought from cyanogen troubles in gas-works practice (where liquors are circulated to bring them up to strength), by admitting the air used to effect concurrent aeration of oxide in the purifiers at more than one point, in such a way as to effect oxidation of ammonium sulphide under controlled conditions (with concurrent formation of thiocyanate), without much exceeding the equivalent of polysulphide. At a somewhat later date—in April, 1918—an opportunity was afforded, through the courtesy of the manager at one of the larger gas-works in the neighbourhood of London, to determine the effect of aëration on ammoniacal liquor under exceptionally favourable conditions. The experiments were carried to completion; but the results afforded no expectation that the volatile cyanide in the crude gas coal could be reduced to the desired figure by simple aëration of circulated liquor. Pressure of space forbade inclusion of the results of these experiments in the reports for 1918 or 1919; but it may be of interest to present the data in abstract form for the information of those who may be working on similar lines.

### WORKS TESTS.

Operations at the gas-works in question were greatly disorganized by the war; and the arrangement and working of the scrubbing plant left much to be desired at the period when the tests were taken.

At that date, coal gas from the hydraulic main passed through an elaborate system of air and water cooled mains prior to entering the centrifugal washer (a Kirkham, Hulett, and Chandler, 5 ft. diameter by 18 ft. high, with nine compartments). At a point just prior to the washer, a limited and strictly controlled supply of air was admitted by meter, and passed with the coal gas through the washer. From the centrifugal washer the gases passed to No. 1 scrubber, a faggot-packed tower, 25 ft. high by 7 ft. diameter, and thence to a second and larger scrubber, 35 ft. high by 12 ft. diameter, packed with coke. Just beyond the second scrubber, and in the main leading to the purifiers, a further limited supply of air was admitted through a meter, and by the agency of a steam-injector, which also served the purpose of supplying the small amount of steam found necessary for the efficient working of the boxes.

Liquor condensed in the air-cooled main above referred to and in the purifiers and connections, together with liquor used to flush-out periodically the hydraulic main, was collected in a well; and the combined liquors were circulated on the centrifugal washer. No. 2 scrubber at that time was fed with liquor drawn from the centrifugal washer, and No. 1 scrubber with effluent liquor from No. 2; the liquor on both scrubbers being duly circulated by pumps until the Twaddel reached the desired figure. The final liquor from the well feeding No. 1 scrubber was withdrawn periodically for storage and ultimate distillation in the sulphate-house. The arrangement of plant was temporary, and has since been changed; and it is only recalled in order that the reader may realize precisely the direction of flow of crude coal gas and liquor during the period of the test.

The test procedure was simple. Continuous samples of the feed and effluent liquors were taken each day at the centrifugal washer and No. 1 scrubber respectively, throughout the whole test period of four hours; and the representative samples thus obtained were submitted to analysis in the laboratory. Sulphide, cyanide, and thiocyanate were determined; the figures for sulphur as "thiosulphate" being calculated from the amount of iodine used for oxidation of the filtrates from the corresponding sulphide determinations, after addition of an excess of ammoniacal zinc chloride. The "outlet" samples are not, of course, precisely comparable with the "inlet" samples in point of time; but with a full flush of liquor on the scrubbing apparatus, and continuous sampling, a comparison of the ammonia, sulphur, and cyanogen distribution figures may be accepted as affording a sufficiently aproximate measure of the oxidizing effect of air on the circulated liquor.

It was not found practicable, single handed, to sample the gases entering and leaving the various sections of the apparatus concurrently with the sampling of the liquor; but the results of the tests recorded in Table I. indicate that the oxygen in the air admitted by meter at the centrifugal washer, though large relative to the oxygen equivalent to the sulphur oxidized in the liquor, was small compared with the total oxygen content of the crude coal gas.

TABLE I.—*Analysis of Crude Coal Gas and Air Entering and Leaving Centrifugal Washer. (July 23, 1918.)*

| — | Entering. | | | Leaving. |
|---|---|---|---|---|
| | 12.55 p.m. | 2.55 p.m., 20 min. after charging | Mean. | |
| *Mixed Coal Gas and Air Entering*— | | | | |
| Average volume— Cubic Feet per Min. | | | | |
| Coal gas . . . . . 750 | | | | |
| Air . . . . . 11 | | | | |
| Oxygen admitted—P.Ct. total gases | .. | .. | 761 | .. |
| | .. | .. | 0·3 | .. |
| *Composition*— Per 100 Vols. | | | | |
| $CO_2 + H_2S$ (by potash) | 5·35 | 5·55 | 5·45 | 5·55 |
| Illuminants (by bromine water) | 3·45 | 3·85 | 3·65 | 3·75 |
| Oxygen (by phosphorus) | 1·50 | ·90 | 1·20 | 1·30 |
| Hydrogen, &c., by difference | 89·70 | 89·70 | 89·70 | 89·40 |
| | 100·00 | 100·00 | 100·00 | 100·00 |
| Calculated oxygen removed by sulphur compounds oxidized— C.Ft. per minute | .. | .. | 0·03 | .. |
| Oxygen admitted by meter— C.Ft. per minute | .. | .. | 2·2 | .. |
| Total oxygen in crude coal gas— C.Ft. per minute | .. | .. | 9·1 | .. |

TABLE II.—*Action of Air on Ammoniacal Liquor Circulated on Centrifugal Washer and Scrubber No. 1. (April, 1918.)*

| — | Centrifugal Washer. 5 ft. Diam. × 18 ft. High. Nine Compartments. Mean of Four Tests. April 5, 12, 19, 23. | | | Scrubber No. 1. 25 ft. High, 7 ft. Diam.— Faggot Packed. Mean of Three Tests. April 5, 12, 19. | | |
|---|---|---|---|---|---|---|
| | Inlet. | Outlet. | Difference P.Ct. of Total Entering. | Inlet. | Outlet. | Difference P.Ct. of Total Entering. |
| *Crude coal gas*— | | | | | | |
| Temperature . °C. | 29 | 27 | .. | .. | .. | .. |
| Volume (15·6° C.)— C.Ft. per min. | 750 | .. | .. | .. | .. | .. |
| *Air admitted by meter*— | | | | | | |
| Volume (15·6° C.)— C.Ft. per min. | 12·5 | .. | .. | .. | .. | .. |
| P.Ct. of crude coal gas | 1·7 | .. | .. | .. | .. | .. |
| *Liquor circulated*— | | | | | | |
| Temperature . °C. | .. | 27 | .. | 18 | 17 | .. |
| Volume— Gallons per min. | 2·8 | .. | .. | 3·4 | .. | .. |
| Composition— | | | | | | |
| Ammonia— Parts per 100. | | | | | | |
| Free . . . . | 1·343 | 2·077 | 55 | 1·966 | 1·977 | .. |
| Fixed . . . . | ·469 | ·539 | 15 | ·480 | ·500 | .. |
| Total . . . | 1·812 | 2·616 | 44 | 2·446 | 2·477 | + 1·2 |
| Sulphur as— | | | | | | |
| Sulphide . . . | ·2000 | ·2559 | 28 | ·2152 | ·2163 | .. |
| Thiosulphate . | ·1347 | ·1491 | 11 | 1317 | ·1302 | .. |
| Thiocyanate . | ·0775 | ·0899 | 16 | ·1021 | ·1018 | .. |
| Total . . . | ·4122 | ·4949 | 20 | ·4490 | ·4483 | — ·2 |
| Cyanogen (calculated as HCy) as— | | | | | | |
| Cyanide . . . | ·0248 | ·0415 | 67 | ·0502 | 0498 | .. |
| Thiocyanate . | ·0656 | ·0760 | 16 | ·0861 | ·0859 | .. |
| Total . . . | ·0904 | ·1175 | 30 | ·1363 | ·1357 | — ·5 |

*Oxidation Effected.*—Volume of air utilized, calculated from oxygen equivalent to sulphur oxidized in centrifugal, c.ft. per minute, 0·35 (air admitted, 12·5).

Thus, while on July 23, 1918, only 0·03 c.ft. of each 2·20 c.ft. of oxygen entering the crude gas main per minute through the meter was usefully employed in the centrifugal washer, the total oxygen content of the gases leaving the washer exceeded 9 c.ft. per minute.

In Table II. are presented the average results of the analysis of the various samples of liquor, and data relating to the working of the plant during the period of the tests. The amount of oxidation effected in the centrifugal washer is undoubtedly low, considering the temperature of the liquor in circulation (27° C., 80° Fahr.) and the excess of oxygen present; but the increase in the figures for ammonia, sulphide, and volatile cyanide is very satisfactory indeed, and indicates that, had it proved practicable to maintain the liquor at air temperature (60° Fahr.) during circulation, a liquor of full strength might have been obtained in the one apparatus and sent direct to the sulphate-house for distillation, in place of being utilized on secondary scrubbers, where the added effect was negligible.

The effect of liquor circulation on No. 1 scrubber is disappointing, but hardly surprising, considering the strength of the feed liquor. No discernible oxidation seems to have taken place; and the absorption of ammonia is extremely slow, and could barely have recouped the management for the cost of pumping.

The experiments generally confirm the conclusion that, wherever practicable, the working of plant for the manufacture of coal gas and the handling and treatment of bye-products obtained in the gas-works should be under the supervision of the chemist equally with that of the engineer.

## PURIFICATION BY OXIDE OF IRON.

**[From the Report for 1920 of Dr. T. Lewis Bailey, Chief Inspector under the Alkali Works Regulation Act.]**

BURNT OXIDE AND WOOD CHARCOAL AS CATALYSTS.

Of the various gases scheduled as "noxious and offensive" by section 27 (1) of the Alkali, &c., Works Regulation Act, 1906, sulphuretted hydrogen is, perhaps, the most important, and that most widely met with by the inspector in the course of his duties. Gas-liquor works, sulphate and muriate of ammonia works, sulphide works, alkali waste works, bisulphate of carbon works, and tar works are all subject to registration, and together total more than half the number of separate processes subject to inspection. At many of these works, sulphuretted hydrogen is evolved in quantity, and calls for special treatment; and the number of works of this character would be enormously increased were account taken by the inspector of coal-gas purifiers other than those in use at sulphate of ammonia works operating the direct process. It will not be a matter of surprise, therefore, that so much of the time available for technical research in the laboratory of the Chief Inspector has been devoted to an elucidation of the many problems connected with the evolution and treatment of sulphuretted hydrogen and of the gases associated with it in the distillation of ammoniacal liquors from coal-carbonizing processes.

Systematic research on the working of oxide of iron purifiers originated, in 1911, with an inquiry into the conditions making for the maximum efficiency of oxide purifiers in use in sulphate of ammonia works and gas-works. The work was further extended in 1912 and 1913 to include an investigation into the efficiency of bog ore and other hydrated oxides of iron, using for analysis a gas-burette of special design. In 1915, the direct process for manufacture of sulphate of ammonia first came under observation; and the experience gained from the study of the working of oxide of iron purifiers in the older process of sulphate making found useful application in the elucidation of some of the many problems connected with the anomalous behaviour of oxide purifiers in the direct process. During the course of the investigations referred to, the theoretical aspect of oxide purification received the closest attention and study. In 1911, so far as could be ascertained, the working of oxide of iron purifiers in sulphate of ammonia works was in many respects an unexplored field of inquiry; and managers, in general, appeared to be content to regard the sulphate of ammonia purifier as a rough-and-ready piece of apparatus, more or less beyond control, and subject on occasions to failure, which was regarded as inseparable from the intermittent operation of the apparatus to which it was attached and the vagaries of the British climate. In gas-works practice, however, purifier working has always been more carefully controlled, and the conditions for maximum efficiency have long been generally known, though not always strictly applied in working.

The oxide purification process has usually been regarded as one of exceptional simplicity, proceeding on the line of equations which represent the ferric oxide (or hydrate) as a catalyst, promoting combination of sulphuretted hydrogen and oxygen, and itself ultimately appearing without change. In practice, however, results are often the reverse of what is anticipated, and purifiers behave with the most provoking irregularity, even when suitably charged and carefully controlled. It is clear, therefore, that whatever be the nature of the primary reactions which take place—and there is good reason for believing that they are free from complication—secondary reactions occur which are of importance in determining the regular working of the system. The nature of these secondary reactions has been the subject of repeated discussions at meetings of gas managers and in the Technical Press; and there is reason to hope that further experience will enable the chemist to exercise complete control over the purification process, which, in a well-conducted works, should be operated with as much care as the coal-carbonizing process itself.

Catalytic processes are widely applied for many purposes to-day, and the conditions making for efficiency are now better understood. Catalysts, in general, are extraordinarily sensitive to degradation by what are termed "inhibiters" or "poisons;" and the precautions necessary to ensure the purity of the combining gases in many processes would appear quixotic, were not practice abundantly justified by experience. Viewed as a catalyst, therefore, it might well be anticipated that the activity of the oxide of iron used in gas-works purification would be closely related to its physical condition, and that failure would result when certain necessary precautions are omitted.

A welcome contribution to the subject under discussion was recently made by Mr. Geoffrey Weyman in two papers read before the North of England Gas Managers' Association in May, 1920, and fully reported in the Technical Press.* The author is disposed to attach great importance to the physical condition of the oxide. A large amount of hydration, he says, is not essential to purification, and, indeed, the maximum activity of certain samples of ferric oxide is attained when the material is dehydrated at a temperature of about 600° C.; but moisture in due proportion may have an important effect in bringing the ferric oxide into a suitable physical condition. Moisture, if present in excess, tends to seal the pores and retard diffusion of the combining gases. The author, following Gedel, regards the conditions *qud* alkalinity of great importance in controlling the nature of the primary reaction products. Under slightly alkaline conditions, such as exist when a due proportion of ammonia enters the purifiers with the foul gases, ferric sulphide ($Fe_2S_3$) is the primary reaction product; and it is the alternate oxidation and sulphiding of this body that yields the free sulphur found in the spent oxide. In presence of free acid (or of ferric sulphate, which acts as such) ferric sulphide is unstable, and suffers reduction, with formation of ferrous sulphide (FeS) and sulphur, with regeneration of free acid:

$$(1)\quad Fe_2S_3 + n(H_2SO_4) = 2\ FeS + S + n(H_2SO_4)$$

The free acid, according to the author, is derived by oxidation of sulphur dioxide formed by the interaction of sulphur vapour on steam:

$$(2)\quad 3\ S + 2\ H_2O \rightleftarrows 2\ H_2S + SO_2.$$

It might be objected, and not unreasonably, that the amount of free acid (or of ferric sulphate) formed is relatively small compared with the total amount of material present, and that the ferric sulphide must therefore predominate in the contact mass under all conditions of working. It must, however, be remembered that there is reason to believe that the activity of a contact mass depends very much on the condition of the *surface layer*, and that in the surface layer, in absence of free ammonia, the amount of ferric sulphate or of free acid may be relatively large. The importance of surface condition in controlling the efficiency of a contact material is well illustrated by the behaviour of the platinum contact mass in an oleum plant, where the maximum weight of platinum with maximum surface is presented to the gases on a "carrier" of relatively preponderant mass.

Equation (1) above might, perhaps, with advantage be expanded as follows:

$$(a)\quad Fe_2S_3 + 3\ H_2SO_4 = Fe_2(SO_4)_3 + 3\ H_2S.$$
$$(b)\quad Fe_2(SO_4)_3 + H_2S = 2\ FeSO_4 + S + H_2SO_4.$$
$$(c)\quad 2\ FeSO_4 + 2\ H_2S = 2\ FeS + 2\ H_2SO_4.$$

Thus a relatively small amount of free acid may cyclically be concerned in reducing a relatively large amount of ferric sulphide. In working practice, the amount of sulphur present as free acid (or as ferric or ferrous sulphate) would hardly exceed 1 p.ct. of the total free sulphur present, an amount related to some 5 or 6 grains of ammonia per 100 c.ft. of crude coal gas entering.

Weyman outlines two possible ways of working the oxide purification process, as suitable under ordinary working conditions:

(1) *Alkaline Conditions.*—A suitable proportion of free ammonia in the crude gas. Use of bog ore highly hydrated, with moderate working temperature in the boxes. Primary product ferric sulphide ($Fe_2S_3$), with oxidation of this to free sulphur and ferric oxide.

(2) *Acid Conditions.*—Complete removal of free ammonia from the crude gas. Use of native oxide (other than bog ore) or burnt oxide. Temperature of gases at inlet to be not less than 70° Fahr. Ferrous sulphide (FeS) as the intermediate product, derived by decomposition of ferric sulphide first formed under acid conditions.

Authorities differ as to the conditions that govern oxidation of the sulphided product. Some maintain that re-oxidation is effected only in the clean boxes, others that sulphiding with concurrent re-oxidation takes place in all the boxes when sufficient oxygen is present in the crude coal gas. The point is one of importance. If sulphuretted hydrogen inhibits re-oxidation, the function of the first two boxes in a set (say) of four purifiers would be concerned solely with sulphiding, that of the last two boxes with revivification; and the conditions sought to be established in the respective zones should be those best favouring the reactions named. On the other hand, if re-oxidation can proceed concurrently with sulphiding in the first two boxes, it becomes a matter for inquiry as to what conditions best favour re-oxidation in that zone; since the more nearly the rate of re-oxidation, or, as one may call it, the

* See "JOURNAL," Vol. CL., pp. 256, 489.

"Claus" reaction, approaches the rate of sulphiding, the greater will be the amount of work performed in the earlier boxes, and the less frequent will be the need of change. Indeed, if the oxide in the first box could be maintained in a healthy condition and at a suitable temperature, with a due proportion of oxygen present in the crude coal gas entering, one might be able, conceivably, to complete the "history" of the oxide in one operation; and the working of the system would then reduce itself to charging the boxes and bringing each successively, once, into the premier position in series for final discharge as spent oxide with a full content of free sulphur.

It is this ideal that is inspiring Weyman and other workers. Weyman writes:

> Since acid conditions are favourable, higher temperatures may be employed; and, therefore, oxides of other types may be used. Natural oxides, other than bog ores, and burnt oxide give good results. . . . Ammonia should be entirely removed from the gas so far as the removal of sulphuretted hydrogen is concerned. It is most important to note that the oxidation must also be carried out at a higher temperature, or it will be too slow. . . . Under good conditions, there is no reason why 50 p.ct. of sulphur should not be obtained without more than one removal.

We thus arrive at the ideal condition for working with minimum handling of material; and the cost of emptying and revivifying a box of even moderate size may well approach £10 under modern conditions of labour.

(1) Selection of a suitable material.
(2) Grid area, not less than 0·5 sq. ft.* per 1000 c.ft. of gas per 24 hours, with efficient tar-separator, and downward flow of gas through the purifier.
(3) Maintenance of a suitable reaction temperature in the boxes.

NOTE.—The effect of temperature and condition of oxide *quâ* alkalinity upon purification efficiency is fully discussed in a report of the Purification Committee appointed by the American Gas Association [see abstracts in the "GAS JOURNAL," Feb. 9, 1921, p. 341].

The selection of a suitable material, and the due control of temperature by thermometers and of the composition of the reacting gases by analysis, call for the aid of the chemist. The erection of plant adequately proportioned, and so constructed as may best conserve and most usefully employ the heat developed within the system, is work that demands the aid of the engineer. Hitherto the gas industry as a whole has not been greatly distinguished by a readiness to recognize the need of a due co-operation of the two services in the purifying field. Scientific control is called for there equally as in other technical processes, though the immediate financial return may be less obvious.

These remarks may serve by way of introduction to the immediate subject matter in hand.

## PART I.—BURNT OXIDE AS CATALYST.

The material examined was submitted to experiment in the hope that a study of its exceptional properties might throw some light on the behaviour of artificial and burnt oxides in the purification process. The material is a bye-product, and is produced in quantity. As initially obtained, it is in the form of a filter-press cake containing approximately 33 to 36 p.ct. of moisture, and about 0·25 p.ct. of free $Na_2O$, and is of the following average composition:

| | Per 100 Parts—Dried. |
|---|---|
| $SiO_2$ | 5·52 |
| $Al_2O_3$ | 7·48 |
| $Fe_2O_3$ | 67·00 |
| $TiO_2$ | 8·70 |
| CaO | 0·56 |
| NnO | 0·25 |
| $Na_2O$ | 6·75 |
| Loss on ignition | 3·95 |
| | 100·21 |

The filter-press cake is "activated" for gas purification use by mixing with a small proportion of waste lime and 10 p.ct. of fine coal silt, re-pressing, and burning. The resultant material is soft and somewhat friable, highly permeable to gases, and of a fine brick-red colour. On exposure to sulphuretted hydrogen, no change of colour is perceptible, even after many hours; but after prolonged use as a catalyst, local action commences to manifest itself, and the colour darkens to a light grey when sulphuretted hydrogen is in excess. But on re-exposure to air, the original colour is restored. In presence of a mixture of sulphuretted hydrogen and oxygen, the colour remains unaltered with the fresh material, but an immediate rise of temperature is noticeable, water and free sulphur are produced, and if the supply of gas be maintained the "Claus" reaction actively continues. In fact, the material possesses all the properties of an active catalyst, promoting the combination of sulphuretted hydrogen and oxygen, and itself undergoing no apparent change of condition, either chemical or physical. In this respect, the particular burnt oxide tested would appear to be an ideal catalyst for oxide purification, as its activity maintains itself equally with sulphuretted hydrogen or oxygen in excess. The fresh oxide, however, is markedly more active as a catalyst than the product obtained after continued use, and extraction by carbon bisulphide, though it effects some increase in activity, does not restore the material to its original condition. This is an undoubted disadvantage from the gas maker's point of view.

The investigation conducted here was confined to laboratory experiments at ordinary temperatures, and with mixtures of sulphuretted hydrogen and oxygen varying from about 27 vols. O. and 71 vols. $H_2S$ to 35 vols. O and 60 vols. $H_2S$ per 100 vols. of gas used—the balance being nitrogen. Temperatures varied from 20° to 125° C., with the reaction vessel lagged with cotton wool or immersed in a water bath to maintain the material at the reaction temperature desired.

No opportunity has yet offered itself for extending the experiments to include an investigation of the behaviour of the material in an oxide purifier under gas-works conditions; but it is stated that preliminary trials at a small gas-works have given satisfaction, and that steps are being taken to ascertain by trial the conditions of working best suited to attain maximum efficiency with minimum cost of handling. The results of these trials are awaited with interest.

In the absence of completed data relating to the activity of the material under all possible conditions of working, one is reluctant to theorize as to the class of catalyst to which the material properly belongs. The bulk of the burnt oxide is ferric oxide (with a total iron content of over 65 p.ct., calculated as $Fe_2O_3$), and the temperature of firing would appear to preclude the existence of a hydrated product—certainly a product comparable to natural oxide. At the same time, aluminium oxide, titanium oxide, and combined soda are all present in notable amounts, and traces of calcium oxide and manganese oxide, together with silica. One or more of these substances may act as a "promoter;" and, on the basis of available data, it is not possible to designate one component as catalyst and another as promoter in a complex product of this character.

*(To be continued.)*

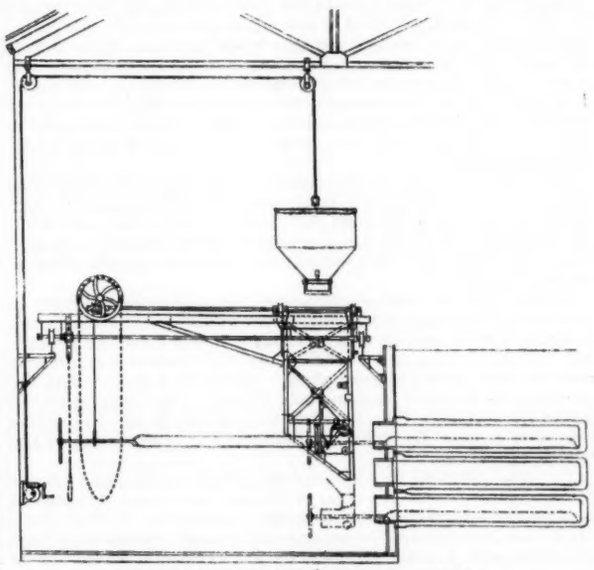
* One square foot per 1000 c.ft. of gas per 24 hours has proved a more reliable figure in certain works.

# CHARGING MACHINE FOR MANUAL OPERATION.

By M. FRÈRE.

**[A Paper read at the Tours Meeting of the Société Technique du Gaz en France.]**

Somewhat on the lines of a mechanical discharger for small horizontal retorts, described at the congress in 1919, the author has now designed and has had in use for some considerable time an installation for charging small retorts by mechanical means operated by manual labour. The apparatus has been named "La Chargette," and has been constructed for the purpose of eliminating the chief part of the labour in the manual charging of retorts—namely, that of raising the coal to the level of the retort by the effort of a man's arms. The coal required for the charging of four or five retorts is accommodated in a skip carried on a travelling overhead crane. The skip slides in a frame forming part



**A French Manual Retort-Charging Machine.**

of the crane; and, by means of a hoisting windlass, it is brought to the level of the retort. The charging scoop, on being pushed forward, opens, by means of tappets, a trap in the lower part of the skip and so arranged that even if the scoop comes to a stop, the coal does not run over its edges. In the front part of the scoop is another tappet, which closes the trap of the skip at the required moment. Thus the workman has simply to handle the charging tool in a horizontal direction, and does not at any time bear the weight of the charge of coal. As soon as the scoop has been introduced into the retort, it is withdrawn along one side of

the latter; and the operation is repeated along the other side of the retort with a second scoop. Numerous trials showed that it was better to carry out the operation at two stages, so as to bring the manual effort easily within the capacity of a man of ordinary strength. Nevertheless, the average time of charging from the two scoops—that is to say, the putting of a full charge in the retort—does not exceed forty to fifty seconds in the case of a practised workman.

The handle of the scoop is replaced by a balancing wheel, presenting the advantage of allowing the workman to thrust the appliance by the upper or lower part of the circle. Hence, in charging the lower retorts he is not compelled to adopt a stooping (almost crouching) position; while for the upper retorts his thrust can be exercised on the lower part of the wheel and the scoop inserted with the greatest facility.

For the filling of the bunker on the charging machine, a travelling skip is employed, mounted on a carriage (from which it can be readily detached) for the conveyance of coal from the store to the retort-house. On arrival at the latter, the skip is attached to a cable and raised to a suitable height, which can be done by one man in about two minutes. By means of a pole, the opening in the skip is operated and the coal discharged to the receptacle on the charging machine. In a works carbonizing 10 tons of coal per day and taking the capacity of the conveying skip at from 750 to 800 kilos, it is necessary to make from twelve to thirteen journeys per 24 hours—say, once every two hours. In this case the coal is handled only once with the shovel, apart from the semi-mechanical charging. If, on the other hand, a greater supply of coal is required, as for a night shift, the necessary skip loads are conveyed beforehand to the retort-house.

Results which have been under observation for eighteen months in a works producing 6000 cb.m. per day, make it possible to say that the charges can be operated by men of average strength after a few hours instruction. It is thought that an appliance of this kind forms a serviceable compromise, in small works, between manual labour and mechanical charging machines, such as the De Brouwer, Cabrier, &c., requiring mechanical power.

## WATER-COOLED ASCENSION PIPES.

By M. SCHNURR, of Lyons.

**[A Paper read at the Tours Meeting of the Société Technique du Gaz en France.]**

The paper described the result of trials, extending over several years, at the La Mouche works, at Lyons, for the purpose of removing the cause of stoppages in ascension pipes. The trials had an entirely successful outcome in the design of a pattern of water-cooled pipe, the use of which has eliminated stoppages.

The experiments were begun more than ten years ago, in consequence of the necessity at that time of working about 300 kilos. of coal in inclined retorts of 4·9 m. length at a temperature of nearly 1100° C. Stoppages in the ascension pipes then became a great nuisance. Almost invariably a pipe became obstructed during each day's working; so that a workman had to be placed on each shift to attend to the clearance, and a gangway was erected specially for convenient access to the pipes. Certainly this frequency of the stoppages arose in some measure from the inclined design of the retorts owing to the more uneven distribution of the charges and the greater height (about 1·40 m.) of the ascension pipes.

It was found that the temperature at the foot of the pipes was over 600° C. during the first three hours of carbonization; afterwards falling rapidly to about 350° C. at the end of the sixth hour. At the upper end of the pipes, the temperature ranged from 450° to 350° C. in the first three hours, and fell to 120° at the close of the distillation.

During the first half of the period, tarry deposits adhering to the sides of the pipes suffer distillation whenever the temperature is above 300° C., leaving a deposit of pitch which goes on hardening and thickening and reduces both the thermal conductivity and the free passage of the pipes. Hence, at a given point, the passing gas becomes continuously hotter. The removal of the cause of stoppages thus depends on the one hand on cooling the pipes and on the other on reducing the temperature of the entering gas.

Previous attempts for the same purpose have followed one or other of these plans. In 1871, M. Rouget used pipes of threefold cooling surface, obtained by external projections. A little later, M. Renaux surrounded the pipes with iron coils which were kept sprinkled with water. M. Gauthier in 1882 used a water-box at the top of the retort in order to cool the gas. This latter plan was first tried at La Mouche, since it did not involve replacement of the ascension pipes. At the foot of each pipe, and 10 cm. above the box head of the retort, a water-spray was installed, similar to the sprays used under the furnaces of producers, but much smaller—delivering from 4 to 5 litres of water per hour. A pressure of about 5 m. of water could be given to the sprays, the use of which completely prevented any stoppages in the pipes. The sprays had the drawback that the delivery nozzle (of only 0·2 mm. diameter) was soon choked in the tarry atmosphere, and thus made it very difficult to obtain a regular delivery of water. But with this arrangement the temperature at the upper end of the ascension pipes during the first three hours was 250° to 200° C.; the pipe was kept clean; and the tars in the hydraulic main were perfectly fluid. There was no need to dredge the hydraulic main; it was readily cleared from the bottom. On the other hand, the water spray diluted the ammoniacal liquors in the hydraulic main, and allowed a collection of tar against the lid of the lower end of the retort, causing a discharge of liquor, which was very objectionable to the workmen, when the door was opened.

Further experiments with water sprays were made in 1910 and 1911; but in the latter year a water-cooled ascension pipe was made and found to reduce the temperature of the gas to less than 300°, and in a more practical manner. The consumption of water, however, was 4 litres per minute—that is sixty times that of the spray. Condensation on the retort head was much less than with the sprays, and consisted only in the running down of tar due to the too great height of the water chamber (4·6 m.). A second pipe of 36 p.ct. smaller section (121 mm., instead of 151 mm. diameter) was used and gave entire satisfaction. The consumption of water was also 4 litres per minute.

In 1912 tubular ascension pipes, fitted with welded water chambers were employed—first for two and then for all the furnaces. Also a cast-iron sleeve was added at the base of the pipe as a protection against excessive wear. By the time these improvements were in use, the water supply allowed of a pressure of 12 m. of water on the retort-bench, resulting in an improved circulation of water.

The final pattern of water-cooled ascension pipe was designed in 1914. It comprised a water chamber, 2 m. high, for the centre retorts, and of 1 m. high for those at the sides. With chambers of these dimensions, condensation of tar on the lids of the retorts almost completely ceased, even if carbonization was continued for eight hours. The benefits of the cooled pipes were strikingly shown from the fact, that from 1914 a workman employed on each shift in charge of eight furnaces, and responsible only for keeping the pipes clear, could be dispensed with. During the whole period of the war, when employing much less efficient labour, the retorts worked without a single stoppage of the ascension pipes. On the enlargement of the works in 1917 by the addition of two benches each of six furnaces of nine 6 m. retorts, all delivering to a single hydraulic main, the enclosing water chamber was unhesitatingly provided for each ascension pipe.

The author gave a diagram showing the arrangements for the circulation of the water, and a section of the rising pipe. Retorts in the mid-portion of the furnace are provided with a water chamber, 2 m. high, but the upper retorts have one of only 1·6 m. high, while the retorts on the side are only 1 m. In the water system there is an inlet for each two furnaces, and a water circulating system for each furnace. Water enters each chamber at the upper part, producing progressive cooling of the gas. The water outlets of the twelve lateral rising pipes of two adjacent furnaces are arranged on one horizontal bench and communicate with a descending pipe provided with a 10 mm. ball adjustment. The ascension-pipes are made similar to those of inclined retorts, having an internal diameter of 160 mm. This dimension might be reduced to 150 mm. At the foot of the pipe a cast-iron sleeve serves to increase the life of this portion, which is exposed to the greatest temperature, and to the chemical action of the products which deposit on it. The cooling water enters at a temperature of from 12° to 15° C., and passes off at 35° or 40° C. Any deposit of lime is thus negligible. The arrangement in use is similar to that of surface condensers of modern electric plant.

It is estimated that every four years the water chambers require to be detached for internal inspection, cleaning, and the removal of any deposit of lime of 1 to 2 mm. thick which may have formed. Passing weak hydrochloric acid through the chambers after two years' use may clear them sufficiently to render subsequent dismantling unnecessary. The consumption of water is from 6 to 7 litres per minute for the midway pipes; and 4 to 5 litres for those on the side. Hence the consumption for the furnace is from 60 to 72 cb.m. per day. One-third of the water is afterwards used for quenching the coke; while the remainder may be employed in various ways.

From measurements made hour by hour, in the course of carbonization, a temperature chart was obtained showing that with a cooled pipe the temperature of the gas at the top does not reach 300° C. The pipe acts as a fractionating column, so that much decomposition is avoided, while the soot which has a tendency to deposit is carried down by the back-flow of tar to the retort lids.

An endeavour has been made to calculate the exchange of heat taking place in a cooled ascension pipe, on the basis that the water enters at 13° C., and emerges at 38° C.—that is to say, experiencing a rise of 25° C. A midway ascension pipe employs, say, 6·5 litres of water per minute (equal to 2340 litres in six hours). For a side retort, these figures are 4·5 litres per minute and 1620 litres in 6 hours. A central ascension pipe thus absorbs $2340 \times 25 = 58{,}500$ cals. during the six hours of carbonization, while in the case of a side ascension pipe the heat absorbed is 40,500 cals.

Part of this heat comes from radiation from the furnace and part from the gases traversing the pipes. The temperature of the gases at the inlet to the cooling chambers averages 600° C., while their outlet temperature averages 200° C. The heat given up by the gases during this fall of temperature from 600° to 200° C may be calculated. For this purpose the charge in the retort is

taken at 480 kilos., and the products of the decomposition of the coal are assumed to be as follows:

| | Per 100 Kilos of Coal. | | Per 480 Kilos of Coal. |
|---|---|---|---|
| Carbon dioxide | 1·60 | .. | 7·70 |
| Benzene | 1·05 | .. | 5·05 |
| Ethylene | 1·05 | .. | 5·05 |
| Carbon monoxide | 2·40 | .. | 11·52 |
| Hydrogen | 1·20 | .. | 5·74 |
| Methane | 6·00 | .. | 28·80 |
| Nitrogen | 1·70 | .. | 8·16 |
| Cyanogen, &c. | 0·20 | .. | 0·96 |
| Total | 15·20 | .. | 72·98 |
| Tar | 4·80 | .. | 23·04 |
| Ammoniacal liquor | 8·00 | .. | 38·40 |
| | 28·00 | .. | 134·42 |

The heat differences represented by a rise in temperature of 400° of these products are as follows, according to M. Le Chatelier's figures, adopted by M. Euchène:

| | | | |
|---|---|---|---|
| Carbon dioxide | 7·70 × (145 − 43) = | 785 | cals. |
| Benzene | 5·05 × (305 − 86) = | 1,106 | ,, |
| Ethylene | 5·05 × (322 − 91) = | 1,166 | ,, |
| Carbon monoxide | 11·52 × (154 − 50) = | 1,198 | ,, |
| Hydrogen | 5·76 × (2150 − 700) = | 8,352 | ,, |
| Methane | 28·80 × (500 − 138) = | 10,425 | ,, |
| Nitrogen | 8·16 × (155 − 50) = | 849 | ,, |
| Cyanogen | 0·96 × (288 − 81) = | 199 | ,, |
| Tar | 23·04 × (374 − 106) = | 6,181 | ,, |
| Ammoniacal liquor | 38·40 × (327 − 96) = | 8,871 | ,, |
| | | 39,132 | cals. |

It will be seen that this figure is fairly close to that obtained for the quantity of heat removed by a side pipe. It is, however, calculated for a central pipe; but if the radiation of the furnace and of other pipes on a central pipe are considered, the calculation may be regarded as satisfactory confirmation.

From cooling tests with pipes fitted with internal air-sprays, the temperature of the gas from 315 kilos. of coal is reduced from 600° to 200° C. The heat absorbed is thus about 25,600 cals. Injection of water at the rate of 5 litres per hour (equal to 30 litres in six hours), gives rise to abstraction of heat by evaporation which may be put down at 30 × 636 + 20 × 96 = 21,960 cals.—the water being assumed to escape as steam at 200° C. Here again the correspondence of the two calculated figures is fairly satisfactory.

In conclusion, the author said the continued use of the pipes has amply proved their merits as regards avoiding stoppages and also condensation on the retort lids. Moreover the tars in the hydraulic mains are perfectly fluid, and there is no reasonable limit to the temperature to which the furnaces may be pushed. In 1914, the cost per furnace was 1000 frs.; now it is 5000 to 6000 frs. But it is judged that the economies of labour, avoidance of loss, and increased yield from the coal quickly extinguish the capital charge.

## A Barring-Down Machine.

Giving to the Empire Gas and Electric Association some water-gas operating tips, Mr. F. C. Hill, of Syracuse, N.Y., alluded to a matter lately referred to by Mr. J. H. Taussig, of Philadelphia—barring clinker off the walls of water-gas sets. Mr. Hill said that one of the most important labour and time saving devices is the barring-down machine, consisting of a heavy bar (600 lbs.) and a suitable prime mover. Before the installation of this machine, it required anywhere from three-quarters of an hour to an hour-and-a-half for a gang of ten or twelve men to complete a barring. Now it only takes from five to ten minutes for a gang of five men. It is therefore evident that the machine aids very appreciably in reducing labour costs and increasing the capacity of the sets. The barring-down machine is very simple in construction. It consists of a heavy bar and a gear-hoist mounted on a substantial four-wheeled carriage. The mechanism of the hoist is such that power is transmitted from an electric motor to a winch-head, and motion imparted to the bar from this winch-head, by the use of a rope and cable. The bar is 16 ft. long, and 4 in. in diameter at the striking end, tapering to 2 in. at the handle end. The bar is connected by a chain to a ⅝-in. flexible steel cable, which runs over a 12-in. steel block placed directly over the coal-hole branch. This cable in turn is connected to a 1-in. rope, which extends 8 or 10 ft. beyond the winch-head of the machine. The machine works about 20 ft. from the coal-hole branch. In barring-down, the rope, having first been wound three times around the winch-head, is pulled taut to raise the bar, and then relaxed to lower it. Three men are employed to pull the rope, and two to guide the bar at the coal-hole branch. It is necessary to replace the rope about once every ten days. With the exception of this, the machine requires very little attention.

Mr. E. V. Evans and Prof. Henry Louis have been re-elected Hon. Treasurer and Hon. Foreign Secretary respectively of the Society of Chemical Industry.

Among those who have accepted an invitation to be present at a luncheon to-day at the Hotel Cecil, in celebration of the 85th birthday of Mr. Edward Owen Greening, who is to be honoured as the founder of the co-partnership movement, are Dr. Charles Carpenter and Mr. Charles Hunt.

# CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

## Report on the Sale and Hire of Gas Apparatus.

SIR,—In your issue of July 13, you gave prominence to a report on the hire of gas apparatus, prepared by a Sub-Committee under the Profiteering Acts of 1919 and 1920.

Without any accusation of profiteering, the report reflects on the efficiency and administration of the Wandsworth, Wimbledon, and Epsom District Gas Company, of which I am Chairman. This Company sold gas for years at the lowest price in London. The report of the Committee is based on that of an accountant, who, without sufficient technical knowledge and without previous experience in gas companies' accounts, furnished figures and conclusions based on a complete misapprehension of the services involved in the stove, meter, and coin-meter business. The report jumps at certain conclusions bolstered-up by the comparison of things which are not comparable. The accountant was given free access to all the Company's books, but did not make it his business to inquire as to facts which would have prevented him from falling into errors which no experienced gas accountant would have made. I was always personally available, and would have been ready to give any assistance in the matter, as were the leading officers of the Company.

On page 6 of the report, there is an imputation that the Company endeavoured to increase its gross profits by charging higher stove and meter rentals, in order to avoid an application under the Temporary Increase of Charges Act, and so to have the dividend reduced to three-quarters of the statutory one. As a fact, the Company did apply; but the Board of Trade could not grant it owing to a technical omission in the Act.

A great deal is made in the report of the decreasing profits and dividends made on the gas-supply part of the business, which was due to war prices and labour difficulties, and which diminished the dividends to less than half of those of pre-war days. The report (based upon absolutely erroneous calculations) purports to show a larger profit on the revenues for meters, stoves, &c., against a smaller one on the revenues of the gas supply; but this is entirely fallacious, as there can be no comparison on this basis.

The provision of stoves and coin-meters in private houses is purely a voluntary business on the part of the gas undertaking, which is under no obligation to supply, and is under no limitation of profit, beyond what might arise as a result of agreement with the hirer. In fact, the amount of profit alleged in the White Paper is not made at all.

It is obvious to any gas engineer or technical gas accountant that no relation between the two elements in their earning capacities can exist. The life of the gas plant averages 45 years, while the stoves, meters, &c., would average under 15 years, besides being very much more liable to obsolescence, owing to modern improvements. The meters, stoves, and fittings are made of comparatively light metals, leather, and perishable substances.

My chief quarrel with the report, however, is with regard to the method employed by the accountant in arriving at his criticisms. He has assumed that the stove, meter, and coin-meter business only bears such proportion of the general charges as the revenue from this part of the business bears to the revenue of the gas supply proper. No experienced gas accountant would have made this blunder; and I have to protest against the report, as the imputation of profiteering is based on allegations of profits which have no existence.

With regard to the charges for repairs, it is common knowledge that by reason of the exigencies of war, and the scarcity of materials and labour, it was impossible during the war years, and to 1919, to carry out the maintenance and replacements; but these had to be made up in the latter part of 1919, and (especially during 1920) resulted in a heavy loss.

On the part of the Company, I am prepared to submit the report in question as well as the Company's books to Sir Alfred Bateman, K.C.M.G., &c., late Auditor of the Metropolitan gas undertakings, Sir H. Haward, late Comptroller of the London County Council, Mr. William Cash, the Auditor of the Brighton Railway, Messrs. Wood, Drew, & Co., or any experienced gas accountant, who realizes the essential difference in the respective sources of revenue.

13, *Queen Anne's Gate, Westminster, S.W.*, *July* 15, 1921. HY. E. JONES.

## How it is Done.

SIR,—Referring to Mr. Helps's letter in the "JOURNAL" of the 13th inst., he takes me to task because I have not answered a question he put to me in his letter of April 9, 1920. This letter was not answered for the reason that I did not make the statement attributed to me in the letter referred to, nor did I use the figure in any tables that I prepared.

I reckon 60,000 c.ft. per ton of 460 gas to be 24 million B.Th.U. If Mr. Helps had been a little stronger in arithmetic, he would have seen that my table was based on 20 million B.Th.U.—I made no mention of inerts. My authority was the word of a gas manager who stated that he had achieved these results; and I accepted the figure exactly as I accepted the figure of 22½ million B.Th.U. per ton which Mr. Helps gave, and his own net coal figures, in adjusting from 30s. to 39s. 2d. per ton for coals, so that like should be compared with like. Is there any inconsistency in this?

Mr. Helps now increases his residuals receipts from a very small fraction of the coal cost up to 22 p.ct.

In his letter published in the "JOURNAL" of May 4, 1920, he states: "I really cannot worry about therms;" and yet his tables before the Inerts Committee are based on therm costs.

My differences with Mr. Helps have never related to the general question of low-grade gas or complete gasification as a physical or

coal-saving proposition, but only on the exaggeration that I claim he indulges in when he applies the acid test of the financial result.

Again accepting his own figure, he claims to make at Nuneaton 49·28 therms per ton of coal on an average gas of 320 B.Th.U., and says that, according to his proposed practice, he can make 200 therms and further reduce the total cost of 8 6Id. to 2·6Id. per therm.

He now has the opportunity of putting his method into practice; but 49 therms per ton when making 320 B.Th.U. grade is certainly not encouraging.

My main criticism, however, was directed against his method of trebling the thermal sale of the Gas Light and Coke Company by a mere stroke of the pen, and then taking the same expenditure item by item as it appears in 1920, except works repairs, which he divides by three.

By what method of reasoning he adds nearly 30 p.ct. to the coal they use, I cannot imagine. He evidently means this in lieu of coke used for the water gas. But, on the other hand, is not this a step towards the complete gasification he so strongly favours, except that it is in two stages instead of one? The advantages of the single stage gasification would, I admit, show up in the working expenses; but to saddle the thermal production with coal not used, is taking liberties with figures with a vengeance.

I cannot see any useful purpose in continuing this discussion, since figures are atributed to me which I do not use, and I am further criticized because I accept the figures of thermal production of one of Mr. Helps's competitors, exactly as I accept his own.

ENGINEER.

*July* 15, 1921.

## Modern Methods of Coal Carbonization.

SIR,—The last word on the fixing of comparative values to modern methods of coal carbonization has apparently been left to Sir George Beilby and his competent staff at H.M. Fuel Research Station, although elaborate researches have been carried out under the auspices of the Institution of Gas Engineers.

As a searcher for results during the last 35 years, I have been particularly impressed with the important position occupied by individual effort, in connection with progress in gas manufacture. The leading items are the work, not of committees, but of individuals. I would prefer to see this position maintained, and hope that modern developments in the direction of collective research will in no way tend to damp the ardour of those individuals whose tastes lead towards further investigations in connection with the various processes concerned in their daily routine.

The industry is now receiving an immense amount of collective information, sometimes consistent with practical experience, sometimes so diverse that there is difficulty in accepting it. One of the points gathered at the recent visit of members of the Institution of Gas Engineers to the Fuel Research Station, was that intensified and prolonged steaming carries practical trouble in its wake—due to the high exit velocities and temperatures of the gases as they leave vertical retorts. Why this should not also apply to horizontal retorts containing the heaviest practicable charges in accordance with modern practice, is not very evident.

Stopped ascension pipes and choked hydraulic mains have been, I might almost say, common to retort-houses since the introduction of the generator type of furnace. They are customarily associated with high temperatures as conducive to hot ascension pipes, and free-burning coal that is rapidly worked-off. I do not think that sufficient importance has been attached to the part taken by the solids in the form of dust, and pitchy matters in a half condensed condition, or to the fact that stoppages cannot take place unless preceded by deposition as a necessary preliminary. Retort-house trouble is usually accompanied by a high pitch content of the resultant tar.

These facts were much on my mind when working-out the steaming downwards process, which was expected to prevent trouble of this character. In practice it has proved a success in this respect, as proved by the Truro experiments. The steam enters at the top of a retort containing a freshly exhausted charge, the upper part of which is at a temperature of approximately 800° C. Passing downward, it meets higher temperatures—up to 1000° C.—at the base, and proceeds through a short duct to the base of a second retort freshly charged with coal. It filters upwards through the charge, fixing with and to some extent protecting the heavy hydrocarbons, and diminishing the secondary decomposition that is a fruitful source of finely divided solid carbon. Experience shows that this can be advantageously maintained for three hours.

Obviously, the exit velocity is increased; but the low temperatures, and the low pitch content of the tar, show that the upper part of the new charge acts effectively as a filter for retaining solid or pitchy matters. The take-off temperature of the gas is consistent at about 130° Fahr.; and the lower temperature in the hydraulic favours a moist gas, and prevention of "salty" deposits. The gas is increased in volume, and carries a high calorific value.

THOMAS SETTLE.

*Leeds, July* 15, 1921.

## Valuation of Combustible Gases on the Therm Basis.

SIR,—In your issue of the 6th inst., there was published an article by Mr. Norton H. Humphrys, entitled "Valuation of Combustible Gases on the Therm Basis," to which I have deferred calling attention until the issue of your current number, in the hope that the author would have some corrections to make.

May I now ask him to check the figures given in Columns 11 and 12 for gases Nos. I. and III.?

Moreover, will he explain the heading and figures in column 13, and show how they are obtained, as it is difficult to interpret their meaning. Surely with gas sold on a heat-unit basis of twenty pence per therm, each combustible constituent ($H_2$, $CH_4$, $C_nH_m$, or CO) will have its own constant value in pence per cubic foot?

W. C. GOODCHILD.

*Derby, July* 15, 1921.

## Imperial Continental Gas Association Capital Stock.

SIR,—On glancing down the stock market report in the current number of the "JOURNAL," I notice that, with reference to this Association's capital stock, in the column headed "Last Dividend," the rate is given as 5 p.ct., and a cross is marked against this figure. Reference to the foot of the report shows that this cross indicates "Next dividend will be at this rate."

I would point out that a dividend at the rate of 5 p.ct. was paid upon the reduced capital stock on June 1 last; and it is quite out of the question to say at this time the rate of the next dividend.

I notice that the same mistake also occurs in your previous issues.

F. H. JAMES, Assistant Secretary.

6, *London Wall, E.C., July* 15, 1921.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF LORDS.

### Progress of Bills.

The Cardiff Gas Bill: Returned from the Commons, with the amendments, agreed to.

The Swansea Gas Bill: Reported, with amendments.

The Waltham and Cheshunt Gas Bill: Returned from the Commons, agreed to, with amendments. Commons amendments considered, and agreed to.

The Harrogate Gas Bill: Read the third time, with the amendments; passed; and returned to the Commons.

A petition has been deposited on behalf of the South Metropolitan Gas Company against the Metropolitan Water Board (Various Powers) Bill.

The Batley Corporation Bill, the Burnley Corporation Bill, and the Rotherham Corporation Bill will be considered by the following Select Committee: Marquis of Bath (Chairman), Lord St. John of Bletsoe, Lord Teynham, Lord Lawrence, and Lord St. Audries.

## HOUSE OF COMMONS.

### Progress of Bills.

The Cardiff Gas Bill: Lords amendments considered, and agreed to.

The Manchester Corporation (General Powers) Bill: Read a second time, and committed.

The Waltham and Cheshunt Gas Bill: Read the third time, and passed, with amendments.

The Paisley Gas Provisional Order Bill: Reported that no Standing Orders were applicable to the Bill; and it was read a second time.

The Wandsworth, Wimbledon, and Epsom District Gas Bill: Read the third time, and passed, with amendments.

The Nelson Corporation Bill, as amended; considered; amendments made; to be read the third time.

A petition has been deposited on behalf of the Altrincham Gas Company against alteration in the Manchester Corporation (General Powers) Bill.

### Monasite Sand and Foreign Control.

Mr. ARMITAGE asked the President of the Board of Trade whether the attention of the Government of India had been drawn to the importance of preventing the sources of supply of monasite sand again falling under foreign control.

Mr. MONTAGU, who replied, said the arrangement made during the war for bringing the Indian supplies of monasite sand under British control were still in force; and no proposal to effect any change had, he believed, been before the Government of India. He had, therefore, had no occasion to address them in the way suggested.

## SWANSEA GAS BILL.

On Tuesday of last week, the Unopposed Bills Committee of the House of Lords ordered the Swansea Gas Bill to be reported for third reading. The proceedings before the House of Commons Committee were noticed in the "JOURNAL" for June 8 (p. 558). A few drafting amendments have been made since the Bill left the House of Commons; but there are no material changes.

**Galashiels Gas Light Company.**—The Company's annual report states that, after applying £1000 towards the cost of the new vertical retorts, the profits for the year amount to £2045. A dividend is declared of 5 p.ct. free of income-tax. During the year 85,917,300 c.ft. of gas were manufactured; and the increased quantity consumed was 3,371,400 c.ft. The price of gas will be fixed when the cost of coal is known. Satisfactory results are obtained from the new retorts. Work has commenced for the erection of a booster fan for automatic street lighting.

**Suction Gas Plant for China.**—In a message from Shanghai, attention is, says the "Iron and Coal Trades Review," again drawn to the increasing demand for suction gas plant in China. While the course of exchange is just now retarding the installation of new machinery on a large scale, the demand for new plant by local electric lighting companies is becoming increasingly urgent. In these circumstances, the employment of suction gas is recommended. In the centres most concerned coal is obtained locally, anthracite usually being available. The installations of suction gas plant at present in operation are stated to have created a favourable impression. It is believed that an important potential demand is developing for prime movers operating on suction gas.

# REGISTER OF PATENTS.

## Distillation of Coal and Similar Carbonaceous Substances.—No. 162,684.

LOW TEMPERATURE CARBONIZATION, LTD., DAVIDSON, T. M., and ARMSTRONG, H. L., of Cockspur Street, S.W.

No. 20,598; Aug. 21, 1919. No. 25,103; Oct. 14, 1919.

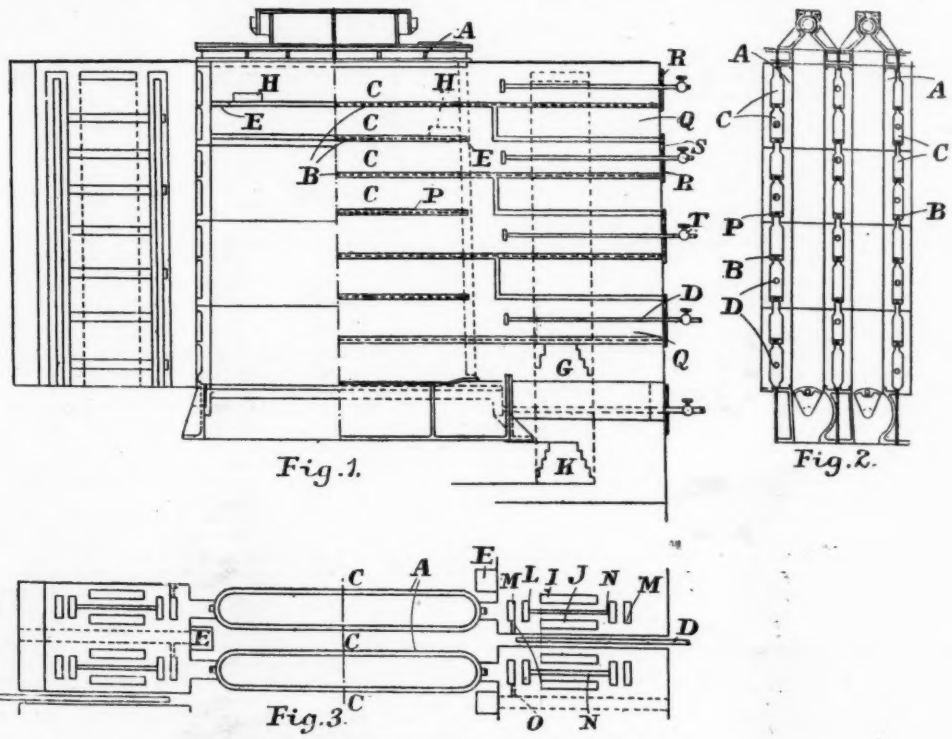
This combined invention relates to retorts having water-jacketed cooling chambers or receptacles beneath them in which the distilled charge may fall, and in which it may be cooled before exposure to the atmosphere. The claims made for the invention are as follows: In the distillation of coal and similar carbonaceous substances, the provision of separate water-jacketed cooling chambers or receptacles for the respective retorts into which the charge falls on discharge; the chambers having each a curved end wall and an opposite vertical end wall in which the outlet aperture is provided. The cooling chambers or receptacles are so set as to provide intervening spaces to form flues for the waste gases; while quenching chambers complete the arrangement.

## Retort-Settings.—No. 164,372.

LOW TEMPERATURE CARBONIZATION, LTD., ARMSTRONG, H. L., and DAVIDSON, T. M., of Cockspur Street, S.W.

No. 20,599; Aug. 21, 1919.

This invention relates to vertical retort-settings "for the destructive distillation of coal at comparatively low temperatures," and more particularly to settings of retorts of oblong cross section.




Retort-Settings for Low-Temperature Carbonization.

The setting is provided with vertical interstitial spaces between the respective retorts to serve as heating chambers, and in which waste-gas flues are provided, formed in two parallel portions separated by a partition wall of small thickness, and having disposed in parallel positions at their sides preheating air-flues, similarly formed in two parallel portions and having communicating passages extending through the partition wall—the waste gases from the heating chambers being discharged into waste-gas flues, while the air to support combustion in the chambers is received from the air-flues. The vertical spaces between the retorts are preferably divided by horizontal partitions into a number of communicating horizontal heating chambers—burners being provided alternately at opposite ends of the adjacent horizontal heating chambers.

Fig. 1 is an elevation partly in section of the retort-setting; fig. 2 is a sectional plan; and fig. 3 a sectional elevation.

In its application to retorts of oblong transverse section, the vertical spaces between the retorts A are divided by horizontal partitions B into a number of horizontal heating chambers C; and in the line of the chambers atmospheric gas-burners D are provided, so that the mixture of gas and air passes along one horizontal heating chamber C, thence downwardly through an aperture E in one of the partitions B to the next chamber C beneath—passing thence in a reverse direction. This second heating chamber C being provided with an atmospheric burner D near the aperture E, the flame and products of combustion pass along the chamber C, together with the products of combustion from the first heating chamber, and together they pass at the opposite end through an aperture E in the lower partition C to the third heating chamber C. In this chamber another atmospheric burner D is provided to discharge a flame; so that the products of combustion are added to those of the other heating chambers referred to, and so on, in succession, until they pass into the waste-gas flues I J.

The communicating apertures E provided at the ends of the horizontal heating chambers are provided with regulating dampers H in the form of blocks capable of being moved more or less over the apertures E in the horizontal partitions B, and thus vary the area through which the gases pass.

It will be understood that each heating chamber C is directly heated by the combustion of a mixture of gas and air from an atmospheric burner D mounted in line therewith. A similar burner is provided for the successive chambers alternately each side of the setting, and that inasmuch as the heating chambers communicate one with the other at their respective ends, the products of combustion of the whole of the preceding heating chambers will pass through the last in the series. The products of combustion thence pass out laterally into the flue G upwards through upstanding waste-gas flues arranged at each end of the setting. The waste gas passes upwards through the flue I, thence downwards through the flue J, and thence into the outlet flue K. etc.

The waste-gas flues are advantageously provided of a number corresponding to those of the retorts, and are disposed in line therewith, and at each side of the flues is provided an upward air flue L and a downward air flue M for secondary air, each pair of flues being also in line with the retorts. Communicating passages N between the pairs of air flues L traverse the division wall between the waste-gas flues disposed between them, so that a considerable surface is presented to the waste gas for effectively heating the air passing through the air-flues. Secondary air is supplied through the flues immediately adjacent to the retorts, where transversely disposed passages extend into passages from the heating chambers C, and in which the atmospheric burners D are disposed.

Means are provided for the admission of secondary air at a number of points in the length of the respective heating chambers. For this purpose a longitudinal passage P is formed in the horizontal partitions B extending to the outside of the setting, and transverse disposed ports or passages are provided at intervals in the length of the horizontal partitions and communicating with them, so that air from the outside may pass through and be delivered at a number of points in the course of the flame through the heating chambers.

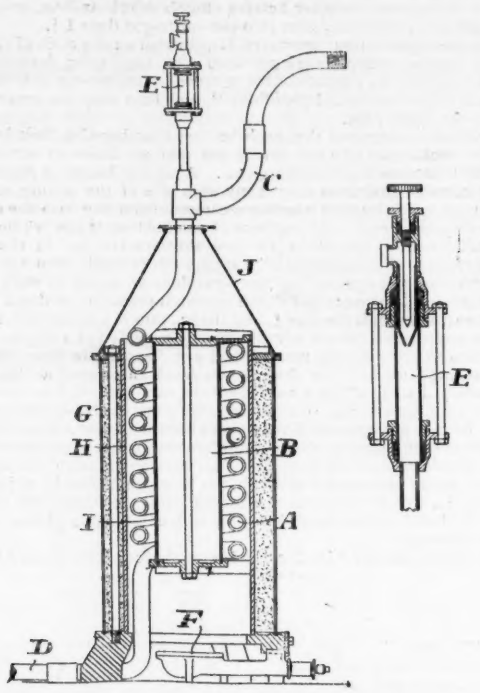
## Vaporizing Petroleum for Mixing with Coal-Gas. No. 164,826.

PARKINSON AND W. & B. COWAN, LTD., of Cottage Lane, City Road, E.C., and PARKINSON, B. R., of North Finchley, N.

No. 7343; March 11, 1920.

This invention relates to apparatus for vaporizing petroleum prior to its introduction into gas mains. It consists of a vertically disposed outer casing, a core supported in the centre of the outer casing, a coil arranged in the annular space between the outer casing and the core, and a gas-burner (for heating the coil) at the lower part of the apparatus.

The invention is illustrated by a part section and part elevation of the apparatus and a section of the sight-feed regulator to an enlarged scale.




Parkinson and Cowan's Petroleum Vaporizing Apparatus.

A is the vaporizing coil, arranged in the annular space between the outer casing and the core B. C is the pipe by which coal gas is supplied to the upper end of the coil; and D is the outlet pipe through which passes the gas saturated with petroleum vapour—this saturated gas being led into the gas-main. E is a sight-feed regulator; and F is the gas-burner for heating the vaporizing coil.

The apparatus is preferably constructed of three cylinders. The outer cylinder G is constructed of sheet iron, or lead-covered steel, while the other two cylinders, H and I (being exposed to heat) are preferably made of weldless steel of considerable thickness. The vaporizing coil should be made of weldless tubing, and its ends are arranged as shown—that is, its upper end is disposed in the axis of the coil and passes through the centre of the cone J, provided at the upper part of the body of the apparatus; while its lower end is at one side of the body of the apparatus and in line with the centre of the annular space obtaining between the outer casing and the inner core. The gas-burner, of the non-luminous type, is preferably made of horseshoe shape—the broken part of the burner, where there is no flame, being in line with the outlet pipe, in order that the flames from the burner shall not impinge on the pipe and unduly heat it. The cone J has at its upper end a damper, by means of which excessive draught caused by the heat from the gas-burner may be checked, and the draught be limited to the extent necessary for drawing in the air required for the proper combustion of the gas—thus conserving the heat produced.

## Gasification of Carbonaceous Material.—No. 164,935.

WOODALL, DUCKHAM, AND JONES (1920), LTD., and DUCKHAM, Sir A. M·D., of Grosvenor Gardens, S.W.

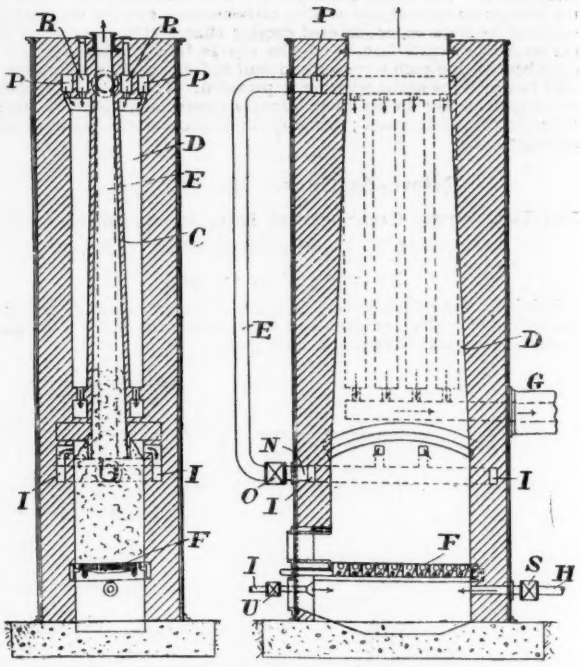
No. 11,802; April 28, 1920.

This invention relates to the gasification of coal and of other carbonaceous matter in which, in addition to the destructive distillation of the hydrocarbons contained in the material, the residue is utilized for the manufacture of water gas by the external heating of the chamber containing the material, and by the passage of the hot water gas through it.

The patentees state that, in the first place, to obtain the best results of carbonization it is desirable that the greatest external heat should be applied to the upper portions of the retort or chamber. Products of combustion from the blow—that is, the heating-up of the fuel bed in the generator portion of the plant—are taken by means of suitable flues to the upper portion of the retort or chamber, and distributed to the external heating flues so as to obtain the desired effect. In the second place, the amount of heat available from the products of combustion made during the blow and the sensible heat of the water gas which passes through the material do not give sufficient temperature to complete the proper carbonization of the material before it enters the generator, and, consequently, a certain amount of hydrocarbons passes away with the blow gases. In order to obtain the increased external heat required for carbonization, arrangements are made to utilize for the purpose a portion of the water gas made in the generator part of the plant—taking the water gas by flues and consuming it in the same external flues as are heated by the products of combustion from the generator during the blow period of working.

In a series of such plants it may be advisable for convenient working to utilize the gases formed during the blow period for heating the boilers, which supply steam for the purpose of making water gas rather than for the heating of the carbonizing vessel. Under these conditions the whole of the external heating of the retort may be carried out either by means of water gas from the generator direct or by means of the mixed gases from the retort.

Inasmuch as the products of combustion formed during the blow period will, it is remarked, contain a certain proportion of combustible gases, arrangements are made for the admission of a secondary air supply to the parts at which the products of combustion enter the external heating flues of the retorts or chambers. This secondary air is preferably heated by the waste gases leaving the external heating flues. The secondary air supply will also be utilized for the combustion of the water gas taken from the generator for the purpose of heating the retorts or chambers during that period of the operation where water gas is being manufactured in the generator portion of the plant.




Woodall, Duckham, and Jones's Coal Gasification Plant.

Vertical sections are shown, in planes at right angles to each other, through a combined generator and retort constructed in accordance with the invention.

The retort or carbonizing chamber (of rectangular horizontal section) tapers upwards, supported on an arch. The spaces between the walls and the setting are subdivided into flues C, communicating at the top with the pipe E destined to convey to these flues the gases for externally heating the retort. The lower ends of the flues communicate with the waste-gas flue G.

The lower portion of the setting consists of a generator, of suitable dimensions for producing the water gas from the residual carbonizing material, preferably of a type that permits of continuous removal of the ashes. In this instance, the products of combustion from the air blast H are led to the top of the installation by the pipe E, where they are distributed to the heating flue D by means of the flue R—secondary air for their proper combustion being admitted by the flue P. Steam is admitted at L, and the water gas passes up through the carbonizing vessel, a portion being taken by means of the pipe N to the flue E, where it is distributed in a manner similar to the blow gases to the flues.

There is a communication N between the annular flue I and the pipe E, controlled by a valve O, the operation of which is as follows: The coal is fed into the top of the retort at such a rate that the latter and the generator are always full, and enters, in more or less completely carbonized condition, into the generator. Here it is blown to the necessary degree of incandescence by the air-blast introduced at H, and the products of combustion pass from the heating flues as described. During this blow period the valve O remains open, and the steam supply at L is cut off. When the fuel in the generator has been sufficiently heated, the air-valve S is closed, and the steam-valve U is opened. Steam now ascends the generator, and the water gas formed passes mainly up the retort.

A certain proportion of the water gas passing through the annular flue I is conveyed through the pipe E to the heating flues at the top of the retort. The proportion of the water gas utilized for this purpose is controlled by regulating the valve O.

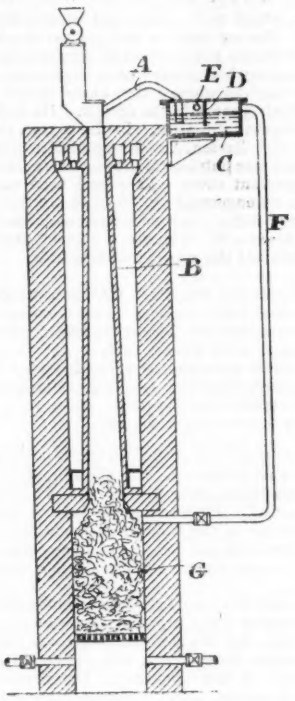
## Gasifying Fuel.—No. 164,949.

WOODALL, DUCKHAM, & JONES (1920), LTD., and DUCKHAM, Sir A. M·D., of Grosvenor Gardens, S.W.

No. 13,373; May 14, 1920.

In a plant for the total gasification of coal or other carbonaceous matter in which one portion of the plant consists of one or more retorts or chambers for the carbonization of the material, and the other (usually lower) portion consists of a generator for the manufacture of water gas, difficulty is occasioned, say the patentees, by the various differing pressures which occur within the plant during

the periods of "blow" and "run" in the manufacture of the water gas. It is usually desired that the products of combustion from the blow period shall not ascend the retorts or chambers and so contaminate the gas made in the carbonizing process, but shall pass from the generator to external flues surrounding the retorts or chambers and heating the latter. By the present invention, a device is provided for eliminating the necessity of any valve on the gas outlet of the retorts or chambers which has to be operated at each period of blow or run. For this purpose the outlet pipe is hydraulically sealed; and the depth of the seal is made to depend on the pressure of gas at the top of the generator, so that the relationship between the pressure at the top of the retort and that at the top of the generator remains substantially the same.




**Woodall, Duckham, & Jones's Fuel Gasifying Plant.**

The illustration is a vertical section through a retort and generator provided with a device constructed for the purpose in question.

The offtake pipe A of the retort B is water-sealed in the pot C, the lid of which has a depending partition D dividing it into two equal compartments. The volatile products escaping from the retort pass away from the left hand compartment by the pipe E; while the right-hand compartment is connected above the water level by the pipe F with the top of the generator G.

The gas pressure in the right-hand compartment varies with that in the top of the generator; wherefore the level of the water in the left-hand compartment similarly varies. The relationship between the pressure at the top of the retort and that at the top of the generator thus remains substantially constant.

## APPLICATIONS FOR PATENTS.

**[Extracted from the "Official Journal" for July 13]**

Nos. 18,054 to 18,670.

BIDDER, M. M.—"Gas fired furnaces." No. 18,196.
BLAKEWAY, J. G. — "Gas-economizers for cooking stoves." No. 18,382.
CANNON IRON FOUNDRIES, LTD —"Gas-burners." No. 18,071.
CANTRILL, J. C.—See Blakeway. No. 18,382.
CLARK, E. K.—See Bidder. No. 18.196.
CRAIG, A. E.—"Gas-economizer." No. 18,076.
DUFFIELD, F.—"Incandescent gas-regulating burners." No. 18,414.
EWART, J. W.—"Geysers." No. 18,212.
FULLER-LEHIGH COMPANY.—"Manufacture of gas." No. 18,493.
HACKFORD, J. E.—"Rotary engines, compressors, exhausters, &c." No. 18,384.
HAWTHORNE, H. S.—See Cannon Foundries. No. 18,071.
HONEY, A.—"Flow-meters and hydrometers, &c." No. 18,424.
JONES, W.—"Gas-globes." No. 18,151.
LAMPHIER, E. R.—"Measuring calorific value of gas." No. 18,379.
LINDSAY, J. P.—"Obtaining gas from coal." No. 18,366.
MASCHINENBAU AKT.-GES. BALCKE ABTEILUNG MOLL UND MATHYS, A. W.—"Gas furnaces." No. 18,369.
MORISON, D. B.—"Means for maintaining tightness of flanged, &c., bolted joints." No. 18,598.
SCHMITZ, H.—"Safety control means for four-cycle gas engines." No. 18 531.
SILKSTONE, G. H.—"Means for making pipe connections." No. 18,362.
WITHERS, J. S.—See Lamphier. No. 18,379.

# MISCELLANEOUS NEWS.

## EUROPEAN GAS COMPANY, LTD.

The Annual Meeting of the Company was held on Tuesday of last week, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. H. E. JONES in the chair.

The General Manager and Secretary (Mr. F. Eliot Williams) read the notice convening the meeting; and afterwards the Directors' report and the accounts. The former was as follows:

During the past year, negotiations were continued with the various authorities concerned for the relief of the Company's financial position by settling bases for the calculation of gas prices to be applied in the future, and by establishing the amount of compensation due to the Company on account of the losses suffered in preceding years.

Although considerable progress was made everywhere, negotiations were only completed in the cases of Rouen, the adjacent town of Sotteville and most of the outlying communes. A settlement was also reached at Amiens with regard to the basis for the future price of gas; and only the question of the amount of the Company's arrears there still awaits final verification by the Municipality. In the case of the other towns supplied by the Company, temporary prices were arranged, which have been sufficient to restore the Company's financial position, and to recoup a portion of the previous year's losses.

The Directors have, in consequence, the satisfaction of reporting that the adverse position at the end of the last financial year has been considerably ameliorated, and that the accounts for the year 1920-21 close with a substantially reduced debit balance.

In the circumstances, aggravated as they are by the continued depreciation of the French exchange, it is impossible for the Directors to recommend the payment of a dividend in respect of the past year. The considerable improvement in the Company's position, however, since the last report was presented to the shareholders, encourages the hope that the payment of dividends may be resumed at a comparatively early date.

The abnormally high prices which necessarily had to be charged in order to cover expenses, combined with the wave of trade depression in France, caused a reduction in the consumption of gas, which shows a decrease at the rate of 17'3 p.ct., as compared with the previous year.

The contract with the Municipality of Sotteville, adjacent to Rouen, has been prolonged for six years, until 1946; and the average length of all the concessions at March 31, 1921, was 25 years. Advantage has been taken of an opportunity to acquire on favourable terms the works at Wimereux, a small town close to Boulogne, with a concession until 1950.

The continued high prices of materials have rendered it impossible to carry out any considerable improvements or renewals in connection with the works and mains; but good progress has been made with such urgent repairs as could no longer be postponed.

It is with regret that the Directors report the death of Mr. A. T. Eastman who was Auditor of the Company for six years and a Director since 1910. Mr. William Graham Bradshaw, C.B.E., has been elected to fill the vacancy.

There have been several changes in the staff abroad during the year; and the Company have to deplore the untimely death of a valued officer, Monsieur A. Defoy, Manager at Boulogne, who suffered extreme anxiety during the war as Manager of the Company's works at Amiens, which were especially exposed to enemy action.

The Directors who retire by rotation are Messrs. J. Mews and C. C. Carpenter, and the retiring Auditors are Messrs. G. C. Goldsmid and W. B. Brady, all of whom, being eligible for re election, offer themselves accordingly.

### LOSSES OF DEVOTED MEN—A NEW DIRECTOR.

The CHAIRMAN said it was an uncongenial task to have to meet the shareholders a second time without being able to offer them a dividend. The explanation of this he would deal with after he had referred to two other matters mentioned in the report. Those were the death of their devoted Manager at Boulogne, M. Defoy, and that of his (the Chairman's) old colleague, Mr. A. T. Eastman. M. Defoy was Resident Engineer at Amiens during the time of the siege; and the Germans passed twice through the town, and held as hostages many of the citizens. Both times they bombed close by the Company's works; and M. Defoy, his staff, and workmen, had to live in dug-outs. One testimony of the extraordinary care and fidelity possessed by M. Defoy was that the Company had a stock of coal at the time of the first German invasion; and, although the supply of gas was suspended for many months, that stock of coal was, through the means adopted by their Manager, available and undiminished when they started work again after the evacuation. This instanced how vigilant and careful M. Defoy had been of the Company's interests. The Directors had dealt with his widow and two sons on terms corresponding with those customary with the Company, which throughout their history, and to their credit, dealt liberally and feelingly with the interests of those who had given their life's service to the concern. The Board were shocked later in the year by the sudden death of Mr. Eastman, who, as the report said, for eleven years was a Director, and previously to that had been an Auditor. He was an especially genial Director, and dealt in a considerate manner with his colleagues—surrendering his opinions when necessary, and very often giving very useful advice. They regretted his loss very much. The vacancy on the Board had been filled by the election of Mr. W. G. Bradshaw, who was a very well-known figure in the gas industry, an accomplished lawyer of high standing, had been for many years Chairman of the Commercial Gas Company, and Deputy-Chairman of the London City and Midland Bank. Mr. Bradshaw was unable to be with them that day when his election would be brought forward for confirmation. He had had a little surgical attention recently. He (the Chairman) had seen him; but he was not in quite a fit condition to come to the meeting, and so was taking a little rest. The third on the list of casualties had been the loss of their old friend Mr. Joseph Reeson, who had been with them for many years as one of their Auditors. He thought the shareholders would like to have this mentioned, as Mr. Reeson was a very valuable officer, and took great interest in the Company's service over a very long period.

### ON THE ROAD TO RESTORATION.

Coming to the report, those present were probably shareholders in other gas companies. At any rate, they no doubt read their journals,

and so knew the history of gas. They would have learned that this Company had shared not only the vicissitudes, but the waves of misfortune that had robbed the bulk of the English companies of more than half, and in some cases nearly two-thirds, of their dividend. But in their own case, there had been more than a loss of dividend. Three of their works were located close to the zone of the German invasion of France. The shareholders could imagine what it must have been with Boulogne under bombardment, and Amiens actually in the line of fire, and behind that Rouen—the great centre from which all the British supplies of war—materials and food—were distributed. Havre was also close by. They could well imagine what a terrible condition the inhabitants of those places had been in through the war; and how difficult it was for the Company—paying as they did as much as £5 10s. for coal, which before the war they bought at 13s. 6d.—to carry on with profit; and when as last year the rate of exchange suddenly rose to something like 67 frs. to the sovereign, and the Company were paying for coal in gold, and reaping their fruit in debased francs for the time being, it would be seen that no possible scheme of ordinary profit could stand against such a disparity of exchange as this amounted to. He took it the shareholders would be more surprised than disappointed that the Directors had again to tell them in the report, and he in his speech, that the Board did not think it wise at the moment to distribute profits. But if they read the report, it would be seen that they had made considerable advances in their settlements with the towns. There remained the adjustment between the parties of the arrears of profits the Company ought to have made in the years he had described to them, but during which they were not making a profit at all—in fact, in the year of bad exchange they were making a loss, which last year they saw amounted to £344,328. That was a record for one year. The year before, the Directors had given the shareholders half-a-year's dividend, amounting to 5 p.ct.—less, true, than it was before. Last year the loss was colossal. This year the report and the statement of accounts showed they had reduced the balance of loss at the end of last year of £334,328 to a balance of £65,318; and so it would be seen how very largely they had retrieved their position. So satisfactory had this been that, had it been possible, the Directors would have strained a point, and offered the shareholders some small dividend now, because they realized very much how often the smallest payment was better than the absence of one altogether; and this would have comforted and shown them that the Company were on the ascending scale. But as a matter of accounts, they could not pay a dividend while having an adverse balance, unless they could show something to countervail the balance; and this they would get in the rectification and agreement for the indebtedness to the Company for arrears of profits last year. The shareholders would see, once these agreements were arrived at, the Auditors could accept the arrangement as solid assets representing debts due to the Company from the various towns. But until this had been determined, not only were the Directors debarred, but the accountants also were debarred from passing anything in the nature of a divisible profit. But inasmuch as the negotiations were, as the report told them, in an advanced stage, the Directors could not at present do anything.

### AGREEMENTS SETTLED AND UNDETERMINED.

They had agreed with Rouen and Sotteville and most of the communes entirely; and a settlement was also reached at Amiens with regard to the basis for the future price of gas. But there were other arrangements that required settling with the municipalities, who were not in a great hurry to acknowledge their debts and liabilities to the Company. In the case of other towns, temporary prices had been agreed which had been sufficient to restore the Company's financial position, and to recoup a portion of the previous year's loss. At the moment Nantes, Havre, and Caen were all more or less in the balance. But meanwhile they were paying the Company satisfactory prices for gas. The terms on which they were to continue their business relations had not yet been decided in those three cases. The Board were hoping almost every week or month to hear that they had been settled; and, as soon as they were, they would consider the question of an interim dividend on behalf of the shareholders. To have accomplished in a single year the reduction of the balance by at least 77 p.ct. showed how near they were to reaching the shore of absolute safety. As soon as they did this, the Directors, as he had just intimated, would be prepared to deal with the question of the dividend.

### SALES OF GAS AND INDUSTRIAL RESTORATION.

In last year's report, the shareholders might have noticed they had an increase in the sale of gas of 10 p.ct., while this year they had a decrease of 17 p.ct., as compared with the previous year. So that really they were only 7 p.ct. below the year before last. But it would be quite understood that trade was quite as much depressed in France as in England. The French were very diligent people. They worked very hard on the land; and so far as the land was concerned, it was in a magnificent state of cultivation, as the Directors had seen within the last few months on one of their visits to the stations. But the manufacturers of France were standing still; and capital was very hard to get there. However, in a money article in that morning's paper, there was, the writer stated, great promise of rapid recovery in France: and this confirmed what he himself had predicted on a previous occasion—that this industrious and thrifty nation would soon restore its balance. When he said that, exchange was standing at 63. It was to-day 46·75, and had been as low as 45. Before the shareholders met next year, it would be materially restored, because the industry, the thrift, and the honourable dealings of the people were beyond all praise. The Company realized this in all their transactions, and in the settlement of such difficult questions as to what they should charge for gas, what they should be paid for arrears, and what they should be allowed to pay as future dividend. The French people had no grudging disposition towards them. Very different was it from what the English companies were meeting with, and had met with, when they were allowed by Act of Parliament to pay only three-quarters of their pre-war standard or maximum dividend, although they served the nation so well during the war. The Company were safe in the hands of the French people; and they would be prosperous again before long, as they were in the days when they made and declared very satisfactory—indeed handsome—dividends. The average length of their concessions to-day was, under these arrangements, twenty-five years, which was a good look-ahead in the circumstances.

### AN ACQUISITION.

For a comparatively small consideration, the Company had acquired the gas-works and lighting of Wimereux, which was a watering suburb of Boulogne. The latter had now become a great harbour and shipping port. Owing to this some of the inhabitants had been driven away to Wimereux, which was only some 1½ miles distant. It was perhaps foolish of the Company not previously to have undertaken the lighting of the suburb. But now the Directors had not the slightest doubt, when favourable circumstances came round, this would be a factor in the economy of the Company.

### A POST REPORT SETTLEMENT.

He thought he would only weary the shareholders by going into further matters. Seeing that he had no dividend to offer them, he should not like to throw any amount of statistics at their heads. The policy of the Company had always been to give any information which the shareholders might require if they chose to call at the office. But they did not publish generally the details. He had forgotten to mention one rather important matter. In the report, the Directors stated that agreements with Rouen, Amiens, and Sotteville had been settled; but since the report was published, they had also settled with Boulogne. This was an important town. They had been successful as well in obtaining for the management of the works in the place of M. Defoy a new officer—very skilful, well educated, and, the Directors believed, a very able manager—M. Guernut. The Chairman concluded by moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Dr. C. C. Carpenter) seconded the motion. He said that this had been proposed by the Chairman in his usual clear and explicit manner; and for this reason he did not think he could usefully add anything to what he had said.

Mr. BUDDEN asked whether the printed report the Chairman had been quoting would be distributed among the shareholders.

The CHAIRMAN replied that it would.

The motion was unanimously carried.

### RE-ELECTION OF DIRECTORS AND AUDITORS.

The CHAIRMAN said it was now his pleasant duty to move that his colleague, Mr. John Mews, should be re-elected a Director. Mr. Mews was known to them all. He was a great banker, and a great lawyer. He was also a member of the Board of a most important London Gas Company; and therefore had full knowledge of gas administration.

The DEPUTY-CHAIRMAN seconded the motion, which was very cordially agreed to.

The CHAIRMAN said his next duty was to move the re-election of his right worthy colleague, Dr. Carpenter, their Deputy-Chairman. He (the Chairman) might tell the shareholders that, when they found Dr. Carpenter was willing to accept a seat at the Board, they felt great benefit must accrue to the Company. Dr. Carpenter was, besides being an eminent engineer, a very eminent chemist; and he had been President of the Society of Chemical Industry. With the developments the gas industry had had before and during the war, this kind of knowledge and that kind of pursuit were essential to its success. Apart from this, Dr. Carpenter's administration of the great South Metropolitan Gas Company gave him a position in the gas world which was, he might say, paramount, or at any rate second to none.

Mr. FRANK H. JONES seconded the resolution, which was very heartily agreed to.

The CHAIRMAN said he was sorry Mr. Bradshaw could not be present that day. They had in him a gentleman who was an expert in gas. He (the Chairman) would like to say here that he cordially endorsed the view that gentlemen who came on to the boards of gas companies should be valuable either from their knowledge of the gas business, of law, or of finance, so that they might be qualified to serve the interests of gas companies in a proper way. He was proud to have on this Board the gentlemen whom they now possessed; and so he had great pleasure indeed in moving the re-election of Mr. Bradshaw. He had known him from his boyhood. He was a man of honour and a polished gentleman; and he was a very careful guardian of any interests entrusted to him.

The DEPUTY-CHAIRMAN remarked that, feeling as he did that the addition of Mr. Bradshaw to the Board could not fail to be advantageous to the Company, he seconded the motion most cordially.

The motion was unanimously carried.

Mr. STEVENS proposed the re-election of Messrs. G. C. Goldsmid and W. B. Brady as Auditors at the same remuneration as last year.

Mr. H. S. REESON seconded the motion, which was at once agreed to.

Mr. BRADY, on behalf of himself and his colleague, thanked the shareholders very much for this renewal of their confidence.

### VOTES OF THANKS.

The CHAIRMAN said it was his pleasant duty to propose a vote of thanks to the staff abroad and at home. The Company had eight distinct areas of supply, eight distinct works, eight distinct staffs and accounts, eight distinct local managements, and eight contracts or concessions with various towns. It needed therefore that they should have very competent gentlemen at the head of their affairs in those towns. They must be capable of meeting the members of the municipality on fairly level terms; and they must be cordial and genial in their relations with them. They must also be capable in their business, and so enable the Company to maintain through their services to the communities their friendly relations with the municipalities. It was when they came to the question of fresh negotiations that the authorities were disposed to examine and cross-examine very carefully the conditions relating to the matters involved. They were, of course, only doing their duty; and they did it very well. But it was at these times that they required managers at the head of their affairs who could diplomatically and wisely conduct the negotiations. At the same time the disposition of the French authorities was totally unlike that of the politicians in this country, and they were always anxious to do justice to those who were serving them in any general public

work like gas, water or railways. It was owing to that ungrudging spirit and anxiety on the part of the authorities to make those with whom they had commercial relations absolutely safe, and to see that they obtained profits that were fair and reasonable, that he felt he could tell the shareholders, as he had already done, that their affairs were safer in the hands of Frenchmen than they would be in those of their own countrymen who were handicapped by political sentiment, of which there was far too much evidence in these times. He was not himself a party politician; but he had been in practice as an engineer for over fifty years, and so knew a great deal as to what went on at Westminster. Then they had their very hard working central staff in the London office. They had been fortunate, after the death of their old friend Mr. W. Williams, in getting into their service, as General Manager and Secretary, his son (Mr. F. E. Williams), who had had experience in the great Imperial Continental Gas Association. That experience during the war he enlarged in the service of the Government. He was made Chairman of an Exports Committee, and acquired very valuable and important experience in that way. Associated with him in the office is Mr. Heather, the Company's accomplished Accountant, for whom he (the Chairman) had the highest regard. They had also Mr. Martin who had been with them a great many years, and knew the undertaking from end to end. Mr. Goldsmid was also a promising officer, who would be heard of in years to come. All these gentlemen were excellent linguists. If the shareholders wanted to know how the Board got on with their officers, they could have the testimony of Mr. Brady, who was now one of their Auditors, and who started with the Company some 45 years ago, but had lately resigned official service.

The DEPUTY-CHAIRMAN said he had much pleasure in seconding the motion. The more he saw of the staff, the more delighted he was with it, and the more satisfied he was that the whole of the members had the interest of the Company truly at heart. While he was on his feet, he should like to return thanks on behalf of himself and his two colleagues for the honour they had paid them in re-electing them to the the Board. They appreciated the honour very highly, and they would leave no endeavour untried in order to do the best they possibly could in the interests of the Company.

The motion was very heartily agreed to.

Mr. WILLIAMS, on behalf of the London staff and the staff abroad, thanked the shareholders very heartily for the kind and cordial vote they had passed to them.

Mr. WOOLF, in proposing a vote of thanks to the Chairman and Directors, said that, although there was no dividend for the shareholders on this occasion, he at all events could not help feeling some degree of satisfaction, inasmuch as their business was in these critical times in very capable hands. They had to do without their dividends on this and the last occasion; but there had been good reasons advanced as to why none were available. He was satisfied with the explanation that had been given by the Chairman; and he looked forward hopefully to better days.

Mr. G. C. GOLDSMID seconded the motion, which was unanimously agreed to.

### WARNING AGAINST DISPOSING OF SHARES.

The CHAIRMAN, in responding on behalf of himself and his colleagues, said it was always encouraging to receive such a pleasant vote of thanks. But he wished to utter one word of advice to the shareholders. On no account should they be induced to part with their shares in gas companies, seeing that gas properties were improving very rapidly. It was lamentable to him sitting at some Boards to see transfers passing through, where the unfortunate shareholders, probably through stress of circumstances, had to part with their shares. When he came into the European Gas Company, he paid £18 for every share; and he would not take £18 for them now—much less the price quoted on the Stock Exchange.

## MEETING THE STRIKE EMERGENCY IN BIRMINGHAM.

In an interesting account of how the strike emergency was met by the Corporation Gas Department, the "Birmingham Post" says the fact that Birmingham citizens passed through the coal strike with so little inconvenience and discomfort is largely due to the foresight and enterprise which enabled the department to maintain generous supplies to the end.

The gas consumers within the department's area of supply number approximately 200,000, and the gas-cookers installed 163,000; the output of gas per annum from the various works being 12,000 million c.ft. The normal quantity of coal required each week varies from 22,000 tons (or about 55 train loads of 40 trucks each) during the winter months to 13,000 tons (about 32 train loads) during the summer months. When the strike commenced on April 1 the reserve of coal was a fairly large one of from 80,000 to 90,000 tons; and in addition approximately 900,000 gallons of gas oil were in stock for the manufacture of carburetted water gas. These stocks were sufficient at the then rate of consumption to last for a period of about six weeks. From these particulars, some idea will be gained of the immense task which faced the department when the strike proved of a protracted nature. The Corporation were in many respects more favourably situated than most gas undertakings in the United Kingdom, owing to the accumulation of stocks of coal during the winter. The stocks of household coal on merchants' wharves in the city at the beginning of the strike were practically *nil*; and the majority of the inhabitants were therefore dependent almost entirely upon gas-stoves for cooking their food. At the outset of the dispute, the Gas Committee decided that the supply and quality of gas should be maintained as long as possible—at all events for domestic and other essential services of the city; and they were averse to restricting the supply in the early days to factories and business premises, owing to the addition it would have caused to the ranks of the unemployed.

It was necessary to purchase further larger quantities of oil; and this, combined with the mild weather since April and the reduced consumption in the manufacturing districts owing to trade depression, considerably helped the department over a very difficult period. A normal gas supply was maintained for a period of five weeks from the commencement of the strike; and as there were then no indications of an early end of the dispute the Emergency Committee of the City Council instructed the Gas Committee to restrict the supply, in order to make the stocks of coal and oil last as long as possible. Restrictions were brought into operation on May 4, when the gas supply was cut off from the works between the hours of 2 and 4.30 p.m. and 6 and 9 p.m. Every endeavour was made by the engineering and chemical staffs to find substitutes for gas-making fuel; and various experiments were conducted at the works with wood blocks, sawdust, &c. For some few weeks 15 to 20 tons of wood blocks were carbonized daily on one section of the plant. Early in June the stocks of coal had diminished to such an extent that it became absolutely imperative to obtain coal from abroad, if the gas supply to the city was to be maintained. Five cargoes of American gas coal, amounting in all to approximately 20,700 tons, were purchased; the cost of the material being about two-and-a-half times that charged for good gas coal in this country before the strike. This American coal, though not up to the standard of the coal usually carbonized in Birmingham, proved to be fairly satisfactory.

The purchase of foreign coal was deferred until the very last moment, because of its effect upon the finances of the department. The high cost of this coal, the purchase of large quantities of gas oil, and the restricted output of gas, render it imperative that the department should obtain further revenue to meet the charges which have been necessitated by the miners' dispute. In the last week or two of the strike, the cost of manufacturing the gas supplied was approximately 10s. 9d. per 1000 c.ft. The maintenance of the gas supply, even in its restricted form, during the crisis has been no mean task, and has been accomplished only by close attention to the position by the officials, who have passed through a period full of anxiety. A considerable outlay over and above normal costs has been involved; but at a time like that through which the country has just passed, the first consideration was to give as good a supply of gas as possible.

## GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications by gas undertakings to the Board of Trade for Orders under the Gas Regulation Act.

### Burnley Corporation.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 15·46d. per therm.

### Chippenham Gas Company.

The standard prices now authorized in respect of the supply of gas by the undertakers are 4s. per 1000 c.ft. within the borough of Chippenham as for the time being constituted, and 4s. 6d. per 1000 c.ft. beyond the borough and within the limits of supply; and the prices they have asked the Board of Trade to substitute for these are 1s. 10 82d. and 2s. 0·02d. per therm respectively.

### Dursley Gas Light and Coke Company, Ltd.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 1d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

### Kenilworth Gas Company.

The maximum prices now authorized in respect of the supply of gas by the undertakers are 4s. 6d. and 5s. 6d. per 1000 c.ft.; and the prices which they have asked the Board of Trade to substitute for these are 1s. 7d. and 1s. 9d. per therm respectively—with the additions of 1·8d., 3d., and 3 6d. per therm respectively for gas supplied by prepayment meters, for hire of meters, &c.

### DECLARATION OF CALORIFIC POWER.

**Wellingborough Gas Light Company, Ltd.**—460 B.Th.U. (July 16)

## GAS REGULATION ACT ORDERS.

The Director of Gas Administration has forwarded copies of the following further Orders made under section 1 of the Gas Regulation Act. The parts applying specially to the Companies named, and the dates of coming into operation, are noted.

### Cradley Heath Gas Company.

After the declared date—(*a*) the standard price in respect of gas supplied by the undertakers shall be 13·4d. per therm; (*b*) the price of 13·2d. per therm shall be substituted for the price of 3s. 1d. per 1000 c.ft. mentioned in section 32 (price of gas with sliding-scale as to dividend) of the Cradley Heath Gas Order, 1897.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-three-quarters. (July 11.)

### Kingston-upon-Thames Gas Company.

After the declared date—(*a*) the standard price in respect of gas supplied by the undertakers shall be 16·4d. per therm; (*b*) "15d. per therm" shall be substituted for "2s. 11d. per 1000 c.ft." wherever they occur in section 31 of the Kingston-upon-Thames Gas Act, 1900.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half. (July 8.)

## BIRMINGHAM GAS CHARGES.

The Birmingham Gas Committee prepared for submission to this week's meeting of the City Council a report in which they said they had given serious consideration to the financial position of the department, which has been adversely affected by the prolongation of the coal stoppage, and the purchase of foreign coal at an excessive cost. Heavy purchases of gas oil have also been made for the production of carburetted water gas, in order to eke-out the supply of coal; and in consequence of the dearth of coke, owing to the reduced tonnage of coal carbonized, further restrictions have had to be placed on sales of coke, of which large quantities are required for water-gas production. Altogether, the losses sustained by the department through the dispute in the mining industry may safely be put at not less than £140,000. This, coupled with the serious fall in the price of residuals, made it imperative further to increase the price of gas. Taking everything into consideration, and bearing in mind the provision to be made for meeting the cost of the reconstruction now proceeding at Nechells, the Committee were of opinion that the price of gas should be increased by 8d. per 1000 c.ft. (with proportionate adjustments of the quantities of gas supplied per penny through prepayment meters).

The Order which was obtained from the Ministry of Health twelve months ago empowered the Corporation to charge up to 5s. per 1000 c.ft.; but as the present highest rate is 4s. 10d., only 2d. could be added without a further Order. The powers of the Ministry of Health under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, have now been transferred to the Board of Trade, who are prepared to consider a further application under the Act for increasing the maximum price from 5s. to 6s. per 1000 c.ft. The Committee therefore recommended that the Town Clerk be instructed to apply to the Board of Trade for such further Order. The Committee also recommended (subject to the granting of the Order) that, as from the September reading of the meters, the charges for gas supplied be increased 8d. per 1000 c.ft.

## WIDNES GAS SUPPLY DURING THE COAL STRIKE.

[Communicated by ISAAC CARR, Engineer and Manager.]

The Widnes gas-works were in possession of exceptionally large stocks of coal at the outbreak of the strike—sufficient to carry on for about five weeks normal, and with the restricted consumption ten weeks. During the remaining period of the strike, the supply was maintained with excess water gas, some American coal, and colliery refuse. The American coal was excellent both for gas and coke production; and the price, compared with the price of colliery refuse, made the advantage enormously in favour of the imported coal.

The entire stoppage of the alkali and other works in Widnes, in which gas is very largely used for manufacturing purposes, in itself automatically brought about a large decrease in consumption. It was not, therefore, until the latter period of the strike that serious restrictions were imposed. Sufficient pressure was at all times maintained to run the gas-engines at the gas-works which generate the electricity for manufacturing purposes, together with some engines on the district which were able to continue in operation throughout the whole of the stoppage.

The greatest proportion of water gas made during the latter period of the strike was 65 p.ct. The calorific value of the gas on some occasions was reduced to 420 B.Th.U. The distribution of this low-grade gas inflicted great hardship upon the consumers, and gave rise to innumerable complaints, not only on account of the back-firing of atmospheric burners, but also of the length of time that was occupied in doing work. The back-firing difficulty was effectively dealt with by the introduction of the spiral device introduced by the Engineer of the Plymouth Gas Company,* which was successful wherever applied, so apart from the time occupied to do work, together with the greater cost of the low-grade gas, the 95 p.ct. of the houses in Widnes which are fitted with gas cooking appliances of some description managed to carry on.

The reduction in consumption brought about by the stoppage of the works and lower pressures amounted to 30 p.ct. The financial loss to the Gas Department will not be less than £10,000. The present selling price of gas in Widnes is 2s. 9d., 2s. 7d., and 2s. 5d. per 1000 c.ft.; and an all-round reduction of 6d. per 1000 c.ft. was under consideration at the outbreak of the strike. The proposed reduction cannot for the time being be made; but notwithstanding this, it is probable that the Widnes prices of to-day are the lowest in the world.

* See "JOURNAL," Vol. CLIV., p. 689.

## HEREFORD'S SEARCH FOR COAL.

Now that the coal dispute is at an end, some particulars have been given in the local "Times" of the efforts made by Alderman C. Witts (the Chairman of the Hereford Corporation Gas Committee), Mr. Arthur Roberts (the Engineer and Manager), and Mr. T. Newton (the Outdoor Superintendent) to maintain an efficient supply of gas in the city during the fuel shortage. The good supply afforded, the paper says, is due to the untiring energy and ingenuity with which the gentlemen named prosecuted their searches for coal, and, having discovered it, secured its transit in the face of great difficulties. Gas consumers particularly, and citizens generally, are under a great debt of gratitude to them.

On April 1 the stock of coal at the gas-works was 1200 tons, equivalent to about five weeks' normal supply of gas. When it became evident that the strike would be of a protracted character, it was obvious that urgent efforts would be necessary to obtain coal from other than the usual sources if the city's gas supply was to be maintained. Unfortunately, however, other gas undertakings were similarly affected; and their efforts in the same direction intensified the difficulties. For the purpose of allocating the existing supplies of coal, for some unaccountable reason Hereford was included in the Cornwall and Devon district, which, of course, is an importing instead of an exporting area. No assistance could, therefore, be expected from Cornwall and Devon.

A restricted supply of gas had to be resorted to on April 9; but this proved to be quite ineffective to cope with the difficulty. After vainly exploring the usual channels of supply, the Chairman of the Gas Committee, together with representatives of the department, ultimately succeeded in securing a supply of fine slack which, previous to the strike, was considered to be practically useless. By mixing this with a percentage of the existing stock of gas coal, the gas undertaking was enabled to carry on. A fresh difficulty arose at this juncture. As the stock of gas coal at the works was becoming gradually but seriously reduced, it became imperative to increase the percentage of slack, in order to conserve the gas coal. But this resulted in lowering the temperature of the retorts to such an extent that gas making could only be carried on with the greatest difficulty. Lump coal was urgently needed to sandwich between the slack; but it seemed unobtainable. Eventually a number of small lots of coal, totalling 700 tons, were located. On April 28, urgent representations were made in person by the Chairman and representatives of the Gas Department to the South Wales and Monmouthshire Director of Coal Distribution at Cardiff for a permit to move this coal; but the bulk was coolly allocated to other gas undertakings which had made no effort to locate it. Eventually Hereford could only secure delivery of 236 tons.

On no less than ten days during May representatives of the department were engaged in scouring South Wales and buying-up small lots of "outcrop coal," which had to be conveyed to Hereford by road. Much of the transport of the mineral was effected under cover of darkness. It was one thing to discover a stock of coal, and another to get it away. Unfortunately, however, available supplies from these sources were exhausted before May 25.

The night of Thursday, May 19, was a critical and most anxious time; there being but two hours' supply of gas in the holders, and the consumption for a period was greater than the production. This necessitated seeking supplies from elsewhere; and the Local Fuel Overseer, together with representatives of the Gas Department, were successful in securing supplies from the Forest of Dean, Radnorshire, Shropshire, Worcestershire, and Staffordshire. The position, however, again became critical; and Birmingham, Shrewsbury, Gobowen, Ruabon, and Wrexham were hurriedly visited, with the result that limited supplies from Madeley Wood, Cannock, Wednesbury, Stoke-on-Trent, and North Wales became available. These, however, did not suffice; and on May 31 a representative of the gas department visited London, and interviewed Col. Sir Hilaro Barlow, Bart., respecting coal at Rotherwas. This resulted in an order from the War Office for the release of 150 tons, which was conveyed to the gas-works within one week of the date of the interview. The Rotherwas coal being only sufficient for three days, it was, however, necessary to secure further supplies. It was ascertained that a cargo of French gas coal would shortly be arriving at Sharpness; and the Gas Department succeeded in securing 500 tons, which proved in every way satisfactory. The normal pressure of gas was therefore soon resumed.

## DIFFICULTIES OVERCOME AT TYNEMOUTH.

How the Tynemouth Gas Company managed to tide over the duration of the coal stoppage has been explained to the press by Mr. F. C. Willis, the Engineer and Manager of the works. If the normal supplies had been maintained throughout the period of the crisis, the Company would have required over 12,000 tons of coal. At the outset of the dispute, with the effects of the strike in November last hardly worn off, they were faced with the problem of carrying on with a stock of only about 5000 tons of coal. It was a fortunate circumstance that the Company had started to erect a new plant for the manufacture of gas from coke and oil, which was then nearing completion; and, after six weeks, it was decided by the management that at all costs this plant must be temporarily coupled-up to the coal-gas plant, and put into operation.

But this was not all; for great difficulty arose with the steam-boilers. Two large Lancashire boilers of the plant in question were lying outside the building prepared for them, with an immense coke heap intervening. Accordingly temporary steam-pipes were laid from another boiler-house to the new producing plant, which was started in the seventh week of the stoppage. By means of this coke and oil plant they were able to carry on by restricting the district pressures, at the same time reducing the carbonization of coal from a normal figure of about 130 tons per day to about 30 tons, thereby curtailing the available supplies. Fortunately, the Company had stocks of coke amounting to over 6000 tons; and, with the exception of something like 500 tons, which was used in the production of gas, the whole of this was completely cleared for the benefit of the district. The gas made in the new plant used about 50,000 gallons of crude petroleum. Thus oil again saved the situation, and displaced enormous supplies of coal, which would have been required to carry on.

In order to keep the works going, about 2000 tons of coal were purchased—including American, Belgian, and Durham; but considering the enormous cost, it was practically valueless from a gas-making point of view. Had it not been for persistent effort, the supplies of gas would have had to be cut-off from the beginning of June. Even in the last week of the stoppage, a purchase of coke was made to carry the Company through. The normal supply was resumed last Saturday.

**High-Priced Gas at Lerwick.**—The price of gas at Lerwick is very high; having been raised by the Lerwick Gas Light Company from 14s. 2d. to 19s. 7d. per 1000 c.ft. A circular has been sent out, intimating that the Directors will reduce the rate as soon as possible. They state, however, that the only alternative to raising the price now is to close down the works.

## BUDLEIGH SALTERTON AND THE STRIKE.

[Communicated by J. W. GIBSON, Engineer, Manager, and Secretary of the Budleigh Salterton Gas Company, Ltd.]

The gas industry at large has every reason to be proud of the manner in which it has carried on during the longest strike period known. Being connected with a small undertaking, the following statement as to how the situation was met at Budleigh Salterton will no doubt prove interesting to your readers.

At the commencement of the strike, the stock carried was 117 tons of Somerset coal, sufficient for seven weeks normal supply. Taking into consideration that this represented the total coal stock of the town (the local merchants being caught napping), it had the effect of a sudden increase in the demand for gas, necessitating the maximum amount being produced per ton of coal carbonized. As it has always been the practice here, since the introduction of water-gas manufacture, to supply a combustible gas with a limited amount of inerts, it was decided not to deteriorate the quality sufficiently to warrant the readjustment of the gas consuming apparatus on the district, as such adjustment is non-productive of revenue, and with an absurdly low selling price of 5s. per 1000 c.ft., it is necessary that all such expenditure should be kept to the lowest possible minimum.

With an average make of 20,340 c.ft. per ton of coal carbonized, mixed gas (50 p.ct. coal gas, 50 p.ct. water gas), the first ten weeks of the strike period were passed through without any curtailment or restriction of supply. Further, 11 tons 6 cwt. of coal was supplied to the local residents to relieve hardship due to there being no supplies in the town. Having an estimated stock to carry on a further three weeks, it was decided to reduce pressures until our position was safe with regard to the transhipment of foreign coal from the port of unloading; but even at this period a full supply was available nine hours per day. This reduction of pressures continued for a week only, as by securing 20 tons of American and 20 tons of French coal, full supplies were resumed, and have been continued up to the present with the glorious news that English coal (if only Somerset) is *en route* from the collieries.

The idea also of purchasing foreign coal at this period was to conserve sufficient English coal to mix with the imported material to secure efficient heating of the coal-gas setting, as my Directors were fully acquainted with the dire results of closing-down. The average cost of the mixed coal into store—there being an approximately equal quantity of each—was: American, 122s.; French, 104s.; Somerset, 54s.; aver. 92s. 8d. per ton. The average amount of gas produced per ton of such coal was 18,500 c.ft.: the mixture being 50 p.ct. coal gas and 50 p.ct. water gas, as during the first period of the strike. The writer was agreeably surprised at the quality of the coke produced. It was quite suitable for water-gas manufacture, though slightly inferior to the coke in use at normal times. The revenue from this coal, taking the selling prices as the basis, was:

| | | | |
|---|---|---|---|
| Gas sold, 16,700 c.ft. per ton of coal carbonized | £4 | 3 | 6 |
| Coke sold (after making allowance for heating setting, steam boiler, and water-gas manufacture), 8 cwt. | 1 | 4 | 0 |
| Tar, after making allowance for use on plant, 8 gallons | 0 | 6 | 0 |
| | £5 | 13 | 6 |

Taking out the comparative financial results for the strike period and the corresponding period of the preceding year, one is much struck how gas came to be a vital necesity for the community at large.

The results here for the period above named were:

| | | | |
|---|---|---|---|
| 1921, total revenue from gas sales | £801 | 11 | 0 |
| 1920, " " " " | 631 | 0 | 6 |
| Increase | £170 | 10 | 6 |

To my mind, one lesson can be learned very forcibly from the period through which the gas industry has lately passed. That is, the vital necessity of water-gas manufacture for the small as well as for larger undertakings, as I estimate that these works would have closed-down after the first six weeks of the strike, or else have carried on at an exceptionally heavy loss.

## ACCRINGTON GAS BOARD REPORT.

The annual report of the Accrington Gas Board records a total expenditure of £135,692, and an income of £156,609, leaving a gross profit of £20,917, as against £19,656 the previous year. The net profit was £411.

During the year 38,080 tons of coal were carbonized, or 394 tons more than the year before. In addition 26,476 gallons of gas oil were used, costing £1844, or 16·72d. per gallon. The present value is less than one-half this figure. Wages paid were £49,704, an increase of £15,008. Deducting £3452 wages paid in connection with reconstruction work at Great Harwood, the actual increase of wages was £11,556, equal to 6·29d. per 1000 c.ft. of gas. The total wages represented a cost of 2s. 3·06d. per 1000 c.ft. A comparison with 1914 shows a wage increase equal to 172 p.ct. The General Manager (Mr. A. J. Harrison) adds: "It would appear the high-water mark has now been reached, and signs are not wanting that some relief from this burden will be experienced during the present year. The policy of endeavouring to centralize the manufacturing operations with up-to-date plant must tend towards considerable economy, apart from the absolute necessity of work of reconstruction being undertaken."

The gas made was 494,470,000 c.ft., an increase of 31,000,000 c.ft.;

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and the average production per ton of coal (including blue gas) was 12 985 c.ft., an increase of 704 c.ft. The gross receipts from coke, tar, &c., totalled £55,938, an increase of £16,936, equal to 73 p.ct. on the cost of coal—by far the highest return yet obtained. The unaccounted-for gas was equal to 10·87 p.ct. of the production, a reduction of 1·01 p.ct. "The problem is a very complex one," says Mr. Harrison, "and I have in previous reports dealt with the question so exhaustively that I can add little to what has been written, except that as soon as the reconstruction of the works is completed I hope to be able to give the question personal attention, as I am convinced that the greater part of this loss can be saved. The past year has been one of unprecedented difficulties; and to have maintained a fairly satisfactory service with a huge scheme of reconstruction going forward, the manufacturing stations half dismantled, coal troubles, wage advances, trade depression, and a host of other handicaps, and that without advancing the rates charged for gas, and finishing the year financially on the right side, I think entitles the members to feel they have conducted the business of the Board in a satisfactory manner."

## TRADE NOTES.

[For "Journal" Advertisers.]

### The "London" Lamp Controller.

All about the "London" lamp controller is to be found in a booklet newly issued by the Gas-Meter Company, Ltd., of No. 238, Kingsland Road, E. It is a clockwork controller, with special features of its own, which has now been in use in many districts for a number of years. It is claimed for the apparatus that synchronization of the clocks in actual working has been achieved as nearly as it is possible to do so. This is partly due to its being so made as to limit the work of the clock mechanism to keeping time only, and partly due to the construction of the dial permitting practically perfect setting. The clock regulator being in sight, the process of regulating is very simple. The gas-tap (operated by a second train of wheels independent of the clock mechanism) is constructed so that the pilot-light is automatically turned off when the burner is lighted up. It can also be arranged so that the burner may be lighted or extinguished by hand, in case of fog, without interfering with the operation of the mechanism. By a simple adjustment, the controller can be adapted for lighting and extinguishing cluster burners. On a conservative basis, the Company estimate that the saving to be effected by the adoption of the "London" controller is not less than 15s. per lamp per annum. The special gas-tap will save approximately 1000 c.ft. of gas per annum; and there is also to be reckoned the saving in mantles. A useful lighting table is included in the booklet.

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

LONDON, *July* 18.

There are inquiries for pitch for export in the market; but it is thought that some buyers will hold off for a month or two. The value is steady; the minimum value being 80s. net per ton f.o.b. makers' works. Creosote is gaining strength; and it is understood makers' ideas of value are about 8½d. per gallon naked, *ex* works. Other products are unchanged.

There is no news in sulphate of ammonia.

### Tar Products in the Provinces.

*July* 18.

The average values for gas-works products during the week were: Gas-works coal tar, 61s. to 65s. Pitch, East Coast, 80s. to 82s. 6d.; West Coast—Manchester, 77s. 6d. to 80s.; Liverpool, 77s. 6d. to 80s.; Clyde, 77s. 6d. to 80s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluol, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11½d. Solvent naphtha, naked, North, 2s. 5d. to 2s. 6d. Heavy naphtha, North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 9½d. to 9¾d.; salty, 8¾d. to 8¾d. Heavy oils, in bulk, North, 10½d. to 11½d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £20 to £30; salts, £7 to £9. bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

### Manchester District Tar Prices.

The average price realized for the sale of tar in the Manchester district, according to the sliding-scale, for the month of March was £3 5s. 2·34d., and for the month of May, £2 19s. 2·14d. [The price for April was given in the "JOURNAL" for July 6, p. 53.]

## FROM A MARKET CORRESPONDENT.

### Tar Products.

This market is still very unsettled, because, as yet, it is not known at what price fuel will be sold. If the coal output grows and becomes practically normal, it is probable that prices will come down; and they may even be low enough to enable blast-furnaces and coke-ovens to resume operations. In this case, the supply of bye-products would be renewed, and many quotations would fall. At the present, gas companies are producing very little tar, and coke-ovens have not yet


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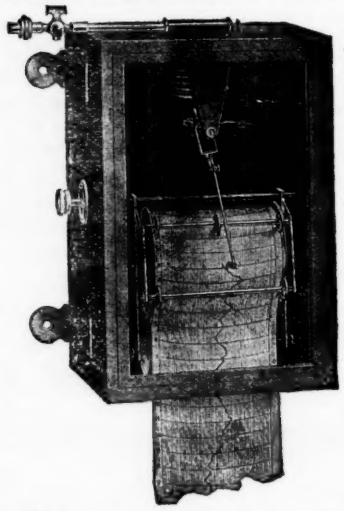

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begun to produce it. Pitch is consequently scarce, although prices remain at about 75s. to 80s. per ton. There is a very good demand for solvent naphtha, as the consuming works, particularly in the rubber manufacturing industry, seem to be getting back to work again. About 2s. 8d. per gallon is the current value; but the price seems likely to improve in view of the scarcity. Naphthalenes are weak, especially crude, which is quoted at about £6 per ton. There is very little demand yet from the fire-lighter trade. Refined naphthalenes remain at about £20 per ton. Creosote is steady at 7½d. to 8¼d. and cresylic acid is 2s. 4d. per gallon for pale 97/99 p.ct., and 2s. 2d. for dark 95/97 p.ct. Carbolic acid is a dead market; crude 60's remaining at 1s. 6d. per gallon and 40 p.ct. crystals at 7d. per lb. There is a slight improvement in intermediate products; and it is anticipated that the demand will be considerable before very long. Little business is passing in salicylic acid at 1s. 3d. per lb. for technical grade. Aniline oil and salts are inclined to be easy in the absence of any special demand.

### Sulphate of Ammonia.

There is very little fresh to report in this market. The quotation, having been reduced to almost a pre-war figure, is practically as low as it is likely to be, and is also relatively as cheap as it has ever been. It would seem that the Sulphate of Ammonia Federation mean to build up a big trade; at the same time they are prepared to meet some strenuous competition, not only from America and Germany, but also from other nitrogenous fertilizers, particularly of synthetic variety, both at home and abroad.

---

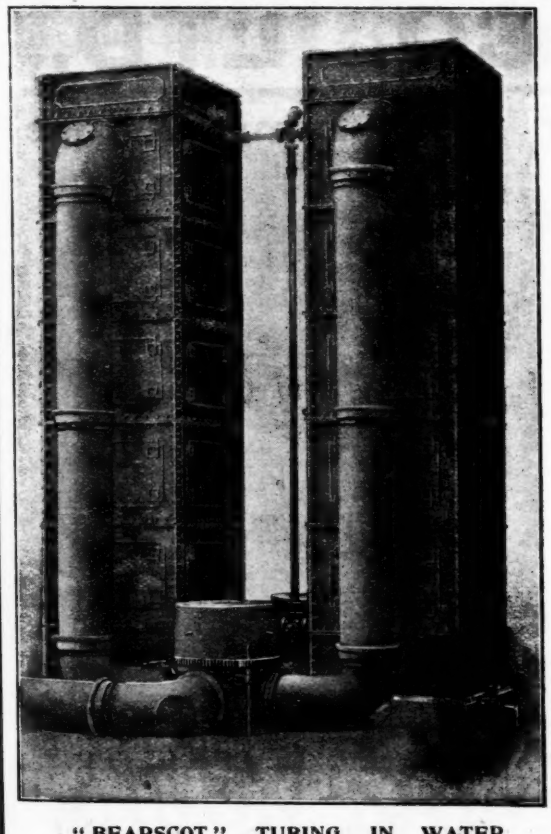
**Fraserburgh Gas Accounts.**—The report of the Corporation Gas Committee for the past year's working records a loss of £690, which has been met by the balance carried forward from last year, leaving a surplus of £181. Gas sales show an increase of £989 10s. 1d. The coal carbonized was 4348 tons, and the yield of gas per ton of coal 10,000 c.ft.

**Boston Gas Company.**—At the annual meeting of the Company last Thursday, a report was presented showing a net loss on the year's working of £1100, after writing-off £1038 for depreciation, allowed under the scheme approved by the Board of Inland Revenue in respect of gasholders, meters, and stoves. The Directors expressed their regret at the deficiency, which was entirely due to the high price that had to be paid for coal during the stoppage of the mines. The balance standing to the credit of the profit and loss account, after paying the interim dividend in February last, amounted to £7051, out of which the Directors recommended the payment of the full parliamentary dividend (less income-tax) upon both classes of shares, which would absorb £962, leaving a balance to be carried forward of £6088. The quantity of gas sold during the year showed an increase, and the number of cookers on hire a small decrease. The report was adopted, and dividends of 4½ p.ct. on the old shares and 3½ p.ct. on the new shares were declared.

**Coal which Produced no Gas.**—At a Ministry of Health inquiry at Heywood, regarding an application by the Corporation to borrow £12,200 for gas-works purposes, reference was made to the difficulties experienced in gas manufacture during the coal stoppage. Mr. W. Whatmough (the Engineer) said they had got coal from mills and from outcrops; but the water-gas plant had really saved the situation. The American coal was the best; but the second lot received was not so good as the first. Alderman Healey (the Chairman of the Gas Committee) said some "coal" was more dirt than coal; and there was very little gas from it. "We have had some coal," he added, "put into the retorts which came out nearly as it went in, and produced no gas."

**Benzole and Bye-Products, Ltd.**—Presiding at the first annual meeting of the Company, Sir Henry Bax-Ironside, K.C.M.G., referred to the coal strike, and said that out of evil came good; for, whereas prior to the strike the coke-ovens of the kingdom were on reduced output, during the strike the Directors disposed of the whole of their accumulated coke at remunerative prices. In some directions the bye-product markets were bare. Such a catastrophe was, however, bound to leave its mark; and their refinery had been almost entirely devoid of raw materials. Their Technical Director (Mr. A. A. Roberts), who had for many months been investigating the manufacture of articles of a highly remunerative nature, chiefly from their own bye-products, had developed these to such an extent that large sale contracts were in negotiation. The profit earned during the first seven months was £27,532; but had the Coal Controller settled their accounts prior to Aug. 31, the net profits of the balance-sheet would have exceeded expectations. Setting aside £10,000 as provision for taxation, there remained a balance of £17,532, being net profit. Payment of the preference dividend to Aug. 31, 1920, including income-tax, absorbed £9719; and there remained a sum of £7813, which had been carried forward.

**Bournemouth War Memorial.**—The head office of the Bournemouth Gas and Water Company was the scene of a simple but impressive ceremony on the occasion of the unveiling of a memorial to the employees who served in the great war. On a base of mahogany rest three bronze tablets—one recording, between the inscriptions "Pro Patria" and "In Memoriam," the names of those who died; while the other two bear the names of those who "also served." The ornamentation of the memorial consists of a laurel wreath in bronze, the coats-of-arms of the three boroughs—Bournemouth, Poole, and Christchurch—and some artistic panelling. In unveiling the memorial, which altogether bears about 300 names, the Chairman of the Company (Mr. William Cash) made fitting allusion to the service of those men who responded to the country's call, and remarked that one-half the entire staff went. He added that the deeds of Britons in 1914-18 would indeed be a rich heritage. Those present at the ceremony included the Right Hon. Sir Daniel F. Goddard, Lieut.-Col. Charles L. Morgan, C.B.E., Sir Charles J. Jessel, Bart., and Mr. E. Honoratus Lloyd (Directors), Mr. H. A. Plumb (Secretary), and Mr. Philip G. G. Moon (Engineer and General Manager).

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## Flood Devastation at Pueblo.

As the result of a series of cloudbursts, following upon an unprecedented rainfall, on the evening of June 3 and the afternoon of June 5, the main business section of Pueblo and several entire residential areas were practically wiped-out. Pueblo, an important smelting place, is the second city in point of size in the State of Colorado, with a population of some 65,000. The high-water mark at the plant of the Pueblo Gas and Fuel Company on June 3 was at the top of the arches of the horizontal sixes, which indicated a depth of water over the entire works of from 8 to 9 ft. Describing the disaster in the "American Gas Journal," Mr. George Wehrle, of Denver, says there is a combination at the works of coal-gas and water-gas plant; but ordinarily coal gas only is made. This part of the plant is hand operated; and the flood came on so suddenly that the stokers fled for their lives. They had been engaged in drawing charges at the time; and so quickly were they compelled to seek safety, that several rakes were found in the partly discharged retorts when the flood subsided. It was 5 o'clock the next morning before the water had subsided sufficiently to permit of the plant being entered by boat. Then immediate preparations were made to estimate the damage and get the water-gas plant started. All this preliminary work was wiped-out on Sunday, June 5, when the city was again inundated; but next morning [Monday] operations were resumed with such energy that gas was turned into the mains in the principal portion of the city at 4.30 p.m. on Tuesday. On examination it was found that the plant generally was covered with about 2 ft. of oozy mud. The coal-gas benches were soaked with water to the top of the arches; and the inside of the settings had several inches of mud, with 5 ft. of water and mud standing in the furnace-pits. The boiler-furnaces were full of mud. The purifier connections were broken off, and one purifier moved 6 in. on its foundation. A 10-in. main crossing the Fountain River, which was the only supply to the residential district on the east side of the river, was washed away for a distance of 600 ft.; while a 6-in. main crossing the Arkansas River, which was one of two feeder mains to the south side, was also washed away. Most of the meters and services in the inundated districts were broken off, and the mains full of water to the gas plant. All the public utilities in the city, including the railroads, were put out of action by the flood; and none except the gas company actually supplied service as early as the following Tuesday, when the water-gas plant was got to work.

**Brechin Gas Company.**—The annual report shows a credit balance on the profit and loss of £1457; and a dividend is recommended on the ordinary shares of 2s. per share, less income-tax. This amounts to £1260, leaving to be carried forward, subject to Directors' remuneration, a balance of £197. The receipts, both for gas and residual products, show substantial increases. The income from gas was £10,593; and from residual products £3084. The present price of gas is 5s. per 1000 c.ft.

**Price of Gas in South London.**—The South Metropolitan Gas Company, who recently temporarily increased the price of gas to 11½d. per therm, in order to meet the extra cost of imported coal, have been asked by Southwark Board of Guardians when the last extra penny would be taken off, seeing that the coal strike was now over. The Company have replied that the heavy loss attributable to the stoppage in the coal industry will only partially be met by the increase in the price of gas in the present quarter. This fact, together with the great falling-off in the price of residuals, made it impossible at the present time to forecast with any certainty future prices or prospects.

**Public Lighting Contracts and the War.**—In the First Division of the Court of Session, the case of the Largo and Lundin Links Gas Company, Ltd., against the St. Andrews District Committee of the Fife County Council was heard. It was a claim for payment of £518 19s. Under a contract dated 1913, the pursuers undertook for a period of fifteen years to supply the defenders with gas at a rate of £1 10s. per lamp per annum. During the war lighting was suspended. On application to the Court, the pursuers obtained annulment of the contract so far as regarded its terms, owing to changes in costs and values. The First Division granted decree for the sum sued for, with expenses.

**Mansfield Gas Undertaking.**—Considerable diminution of profit, compared with the preceding twelve months, is recorded in the annual report of the Mansfield Corporation Gas Committee, which has just been presented to the Council. Against £12,649 in the previous year, the profit during the last annual period amounted to only £6058; and after allowing for interest on loans and contributions to sinking fund, there was a net loss upon the undertaking of £2659, as compared with a net profit in the previous year of £3126. This is despite the fact that £2226 more was received from the sale of gas, and £7019 more from residuals. Coal cost £7986 more; and over £14,500 more than in the previous year was expended upon the manufacture of gas.

**Price of Gas at Hastings.**—Consumers will, says Mr. Charles F. Botley, the Engineer and General Manager of the Hastings and St. Leonards Gas Company, readily appreciate that the long-continued and disastrous coal strike has nullified all hopes or calculations in reference to the current price of gas. Following the exhaustion of the Company's stock of coal, the Directors authorized the maintenance (if possible) of the gas supply, regardless of immediate cost. Thus the supply has been maintained; but the cost of imported coal, much of which is of poor quality, has for some weeks past caused, and is causing, such expense that gas is being supplied at a loss. Though work is being resumed at the mines, some time must necessarily elapse before regular supplies of coal are forthcoming. In these circumstances, it becomes necessary to reconsider the price of gas; and this will be done as the accounts for the present half year are available. Notice is therefore given that any (temporary) increased price, if found to be absolutely necessary, and subject to the approval of the Board of Trade, will date from the Midsummer reading of the meters.


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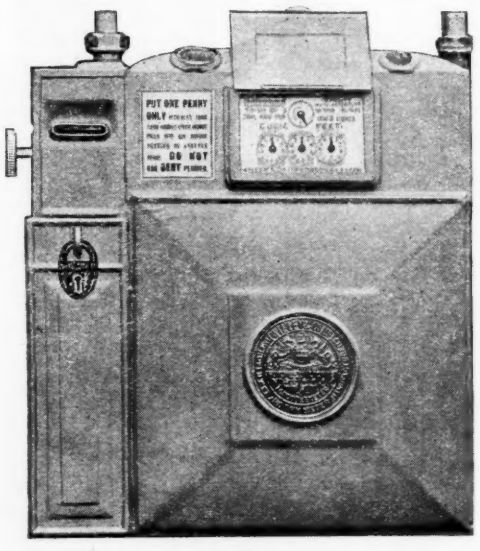


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**Harpenden Gas Company's Dividend.**—Regarding the Harpenden District Gas Company, the Hertfordshire County Council report that notice of application to the Board of Trade under section 1 of the Gas Regulation Act was received by the Council from the Company, proposing to substitute a price of 18d. per therm for 4s. 9d. per 1000 c.ft., the present charge. It was considered that, in view of the figures advanced by the Company in support of their case, the standard price asked for per therm was rather too much. Negotiations were therefore entered into with the Company, who have agreed that for the first three years they shall not pay higher dividends than the pre-war rate of 12½ p.ct. on the original stock and £8 19s. 6d. p.ct. on the additional stock.

**Glasgow Chemical Works.**—Mr. W. A. Walmsley, the Manager of the Glasgow Corporation Gas Department Chemical Works, has submitted his second annual report. In the first portion of the financial year, tar and ammonia products were in great demand. In February, however, tar prices broke; and the export price of sulphate of ammonia came down to almost pre-war rates. The total revenue was £568,428. Sales of products amounted to £491,812; and charges to £143,632, leaving a balance of £424,796. After deducting £9278, representing interest on capital on the book value of the four chemical works, a surplus amounting to £415,517 remains. The Sub-Committee approved of the report, which they informed the Manager was highly satisfactory.

**Value of the Tiverton Gas-Works.**—There was reported to the Tiverton Town Council last week a loss of £1000 in three months on the gas undertaking. A member said the gas-works were in a "rotten state," and another recalled that the undertaking had been described as a "white elephant." Mr. A. T. Gregory, however, pointed out that the works were purchased from a private company at a cost of £20,000. The Council had spent on extensions another £20,000; and if put on the market, the works would be worth £70,000. He could get £60,000 for them, which would be a handsome profit. They were a valuable asset. On the Lighting Committee's recommendation, it was decided to increase from £320 to £370 the salary of the Gas Manager (Mr. T. W. E. Corrigan).

**The Report on Sale and Hire of Gas Apparatus.**—The General Purposes Committee of the Wandsworth Borough Council state that they have had under consideration the report on the "Sale and Hire of Gas Apparatus" prepared by a Sub-Committee appointed by the Standing Committee on the Investigation of Prices under the Profiteering Acts, 1919-1920 [*ante*, p. 109]. The Committee have asked the Wandsworth, Wimbledon, and Epsom District Gas Company "whether they propose to take any steps to reimburse the excess charges which, owing to a misapprehension, were imposed upon a large number of consumers." The Chairman of the Company (Mr. H. E. Jones) deals with the report in our "Correspondence" columns to-day. We can readily anticipate the answer which will be given to the quoted question.

**British Furnaces, Ltd.**—A Company has been registered with a capital of £25,000, to carry on the business of designers, builders, and manufacturers of plant and apparatus for the preparation, treatment, or combustion of solid, liquid, and gaseous matter, furnaces, stoves, kilns, retorts, producers, and other gas-making equipment. If Woodall, Duckham, and Jones (1920), Ltd., the Bryan Donkin Company, Ltd., and the Surface Combustion Company, Ltd., Incorporated, respectively, acquire 2500 shares within seventy days of the incorporation of the Company, they may each appoint not more than three original Directors, who may continue in office during the pleasure of the Companies. The Directors may resolve that any one other Company shall be eligible as a constituent company. The offices are at Millbank House, Westminster, S.W.

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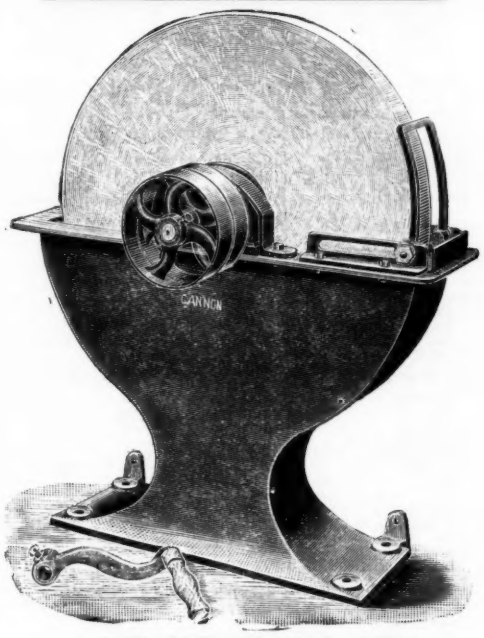
Mr. Henry Lesser, the Secretary, forwards a copy of the report and accounts for the year ended Dec. 31 last of the South Metropolitan Gas Company's Employees' Provident Society, the membership of which at that date was 5158, as compared with 5042 at the close of 1919. The benefit figures go to show that, "while the general health of the members is by no means up to its pre-war standard, there is a marked tendency in that direction; and the sickness experience will doubtless improve as the more immediate effects of the war become less acute." Thanks to the generosity of the Company, and to the judicious exercise of certain special powers available to the Society under the Acts, the members have been able to enjoy a number of additional benefits without waiting for the valuation surplus to be declared. The report is signed by Dr. Charles Carpenter (the President), who says that the Society is administered in the co-partnership spirit; and while that spirit lives, the Society will prosper.

The first annual report and accounts of the Whessoe Foundry and Engineering Company, Ltd., to be submitted at the meeting to-day, relate to the period from the incorporation of the Company on April 9, 1920, to March 31, 1921. The profit for the year, after providing for liabilities to the Government, amounted to £38,621. Against this have been charged: Depreciation on buildings, plant, and machinery, £7617; proportion of profits applicable to the period prior to the incorporation of the Company, transferred to reserve, £904; and preliminary expenses, £2308. This leaves a balance of £27,791, out of which the Directors recommend the payment of a dividend of 10 p.ct., free of income-tax, leaving to be carried forward (subject to Directors' commission on profits) £7791. The Directors say that, during the year under review, the works have been well supplied with orders; and the commitments for the purchase of material were such that the Company have been able to meet satisfactorily the heavy fall in market values of all engineering material. The general industrial outlook for the future is uncertain, owing to dislocation in the engineering and coal trades; but the Company are in a satisfactory position, both as to contracts and financial resources, to meet such conditions.


# "CANNON" GRINDSTONES

## For the Gas Industry.

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**Lichfield Gas Company's Action Appreciated.**—At a meeting of the Lichfield City Council last week, arising out of a report as to the restriction of the gas supply, Alderman Haynes said he was pleased to announce that the Gas Company had now received supplies of coal, and were in a position to renew a normal service of gas. The Mayor said he thought the Gas Company ought to be congratulated upon having kept up the supply as well as they had done. There had been restriction during the past week or so; but previous to that there was no room for complaint. Alderman Haynes remarked that had the Gas Company not assisted their friends and the citizens with coal, there would have been no need for restricting the gas supply at all. The Mayor: I should like to say, on behalf of the Council and the city generally, that we have greatly appreciated what the Lichfield Gas Company have done for the city during the recent coal strike. I am sure it has shown very good management on the part of the Company.

**Hereford Gas Price Reduced.**—Addressing the Hereford Town Council, Alderman Witts (the Chairman of the Gas Committee) said the year's accounts were very satisfactory, the profit being £6721. The total cost of running the works in 1914 was £21,600, while last year it was £52,360. Against an actual indebtedness of £23,700, they had a works, according to the auditor's valuation, worth £165,000. It had been decided to reduce the price of gas 6d. per 1000 c.ft. as from the end of the past quarter; and, if things were favourable, he hoped in a short time to announce a further reduction. Alderman Witts remarked that he would be lacking in his duty if he did not say what a great deal the city owed to the Gas Manager (Mr. Arthur Roberts), the Outdoor Superintendent (Mr. Newton), and the City Coal Controller (Mr. Shimmin), who worked night and day for some weeks in order to get a supply of coal for the gas-works. They were not able to obtain a single hundredweight of their ordinary coal, but had to get supplies from 24 different sources in small lots.

## STOCK MARKET REPORT.

THE Stock Exchange has not had a very brilliant week; movements being fitful and irregular, and at no time indicative of real strength. The opening day was inactive and dull; but things did amend to a moderate degree later. Such improvement as there was, however, was wholly undone on Thursday, when the 6 p.ct. Bank rate was left standing. And so the week closed dull.

In the gilt-edged market, Home Government issues had a further set-back. Of the big four, Consols alone maintained their position, Friday's figures being as follows: Consols 47⅞ 48, War Loan 87⅞-88⅛, Funding 70¼-70¾, Victory 76⅛-77⅛. Bonds also were lower. Colonial Government issues, however, were in good demand, and Corporation stocks were steady. Home Rails, after a little hesitation, were well supported. Canadians were firm; but Argentines weakened.

In the Foreign Market, French, Belgian, Chilian, and Japanese were in favour.

In the Miscellaneous Market, a feature was the improvement in Rubbers; but Oils were a good deal mixed. Some Industrials gave indications of improving trade.

Business in the Gas Market was on a smaller scale than the week before, owing probably to the hot weather driving people out of town without waiting for August. But the good tone did not seem to suffer any impairment. In the London Companies, where prices moved at all they were for the better; Gas Light preference and South Metropolitan preference and debentures scoring advances. In Suburban and Provincial, Brentford, Brighton, Lea Bridge, and Alliance and Dublin moved upward. In Foreign, Imperial Continental was little touched, and Primitiva not at all. Bombay gave way.

**Bargains done for cash during the week were as follows:** On Monday, European 7⅛, Gas Light ordinary 55⅛, 55⅛, 55⅛, 55⅞, 56⅛, ditto maximum, 42⅛, ditto debenture 50½, Imperial Continental 131½, 132, ditto debenture 79, South Metropolitan 68, British (Norwich) 3 p.ct. debenture 42½. On Tuesday, Alliance and Dublin 44, Brentford "A" 66, ditto preference 68, Cape Town debenture 55, Continental Union 19, Gas Light ordinary 55¼, 55½, 55⅜, 56, ditto debenture 50¼, Imperial Continental 131, 132, South Metropolitan 68, South Suburban debentures 73½, Cardiff 7⅛ p.ct. debenture 100¾, Barnet District "D" 68, 68½, ditto 4 p.ct. debenture 52, 52½, Portsea "D" and "E" 9s. 3d. On Wednesday, Brentford "A" 66, Cape Town debenture 55½, European 7 9/16, 7⅛, Gas Light ordinary 55¼, 55⅜, 55⅛, ditto maximum 43⅛, Imperial Continental 131½, 132½, 133, South Metropolitan, 67⅞, 68, 68⅛, Tottenham "B" 54⅜. On Thursday, Brentford "A" 67, 67⅛, 68⅛, British 23, Derby 63½, Gas Light ordinary 55⅛, 55¼, 56, ditto maximum 44, ditto debenture 50⅜, 51, 51½, Imperial Continental 132 (and exceptional 100), North Middlesex 7 p.ct. 7 15/16, 8 1/16, Brentford 6 p.ct. mortgage 96, Brighton and Hove 4 p.ct. debenture 59⅜, 60¼. On Friday, Gas Light ordinary 55⅛, 55⅜, 55⅛, 56, ditto maximum 43, ditto preference 58⅛, Imperial Continental 131, Liverpool 54⅛, South Metropolitan 68.

In the Money Market, conditions, on the whole, have been quite comfortable, though once or twice there was rather an indication of increasing firmness. Discount terms were similarly circumstanced; but the advance did not materialize. Silver was in good demand and the price rose to 37½d. The Bank rate is 6 p.ct., as fixed on June 23.

According to a statement by the Gas Manager, the price paid by the Congleton Corporation for American coal was £4 per ton.

**ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.**

| Issue. | Share. | When ex-Dividend. | Ante-War Dividend & Bonus. | Last Dividend. | NAME. | Closing Prices, July 30, 1914. | Present Prices. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | | |
| 182,049 | Stk. | Mar. 11 | 4 | 4% | Aldershot 4 p.c. Pref. | ... | 53—58 | ... |
| 1,551,868 | ,, | Apl. 14 | 2½ | 3 2/11% | Alliance & Dublin Ord. | 59—64 | 39—44 | 44 |
| 374,000 | ,, | July 14 | 4 | 4% | Do. 4 p.c. Deb | 76—79 | 46—51* | ... |
| 280,000 | 5 | Oct. 28 | 7½ | 8% | Bombay, Ltd. | 5⅛—6⅛ | 3¼—4 | ... |
| 100,000 | 5 | Feb. 25 | 16 | 5% | Bournemouth Gas and Water: 5 p.c. | ... | 7¼—8¼ | ... |
| 383,110 | 10 | ,, | 7 | 7% | Bournemouth Gas and Water: B 7 p.c. | 15—15½ | 8½—9½ | ... |
| 115,000 | 10 | ,, | 6 | 6/- | Bournemouth Gas and Water: Pref. 6 p.c. | 13½—14 | 7⅛—8⅛ | ... |
| 162,065 | — | June 30 | — | 4% | Bournemouth Gas and Water: 4 p.c. Deb. | ... | 54—59 | ... |
| 992,045 | Stk | July 14 | 14 | 30/- | Brentford A Consolid. | 261—266 | 63—68* | 66—68¼ |
| 734,920 | ,, | ,, | 11 | 26/3 | Do. B New | 204—209 | 60—65* | ... |
| 55,000 | ,, | ,, | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 67—71* | 68 |
| 221,400 | ,, | June 15 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 56—58 | ... |
| 214,775 | ,, | Mar. 11 | 11 | 7½% | Brighton & Hove Orig. | 208—213 | 100—105 | ... |
| 244,200 | ,, | ,, | 8 | 5⅛% | Do. A Ord. Stk. | 134—139 | 70—75 | ... |
| 1,287,500 | Stk | July 29 | 5 | 5% | Bristol 5 p.c. max. | ... | ... | ... |
| 530,000 | 20 | Mar. 30 | 12½ | 10% | British | 44—45 | 22—24 | 23 |
| 120,000 | Stk | June 30 | 4 | 4% | Do. 4 p.c. Deb. Stk | 88—90 | 53—56 | ... |
| 245,771 | ,, | ,, | 4 | 4% | Buenos Aires 4 p.c. Deb | 85—87 | 36—39 | ... |
| 100,000 | 10 | May 27 | — | 6% | Cape Town & Dis., Ltd | 1½—2½ | 6½—7½ | ... |
| 100,000 | 10 | Apl. 28 | — | 4½% | Do. 4½ p.c. Pref. | 4—6 | 4½—5½ | ... |
| 100,000 | Stk. | June 30 | 4½ | 4½% | Do. 4½ p.c. Deb. Stk | 70—75 | 53—58 | 55—55½ |
| 157,150 | ,, | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. | 108—110 | ... | ... |
| 1,513,280 | ,, | Feb. 25 | 5/9/4 | 30/- | Commercial 4 p.c. Stk. | 106—108 | 55—60 | ... |
| 560,000 | ,, | ,, | 5½ | 26/3 | Do. 3½ p.c. do | 103—105 | 52—57 | ... |
| 475,000 | ,, | June 15 | 3 | 3% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 42—45 | ... |
| 800,000 | ,, | Dec. 11 | 4 | — | Continental Union Ltd. | 76—79 | 17—22 | 19 |
| 200,000 | ,, | ,, | 7 | — | Do. 7 p.c. Pref. | 115—118 | 30—40 | ... |
| 51,600 | ,, | Feb. 5 | 15 | 10% | Croydon A 10 p.c. | ... | 125—135 | ... |
| 278,400 | — | ,, | 12 | 7% | Croydon B and C 7 p.c. | ... | 95—105 | ... |
| 492,270 | Stk. | — | 6 | 4½% | Derby Con. Stk. | 123—125 | ... | 63½ |
| 55,000 | ,, | — | 4 | 4% | Do. Deb. Stk. | 102—104 | ... | ... |
| 1,002,180 | 10 | Jan. 29 | 10 | 5/0 | European, Ltd. | 17½—18 | 7—8 | 7 3/16—7½ |
| 16,298,975 | Stk | Feb. 10 | 4/17/4 | 30/- | Gas Light and Coke: 4 p.c. Ord. | 98—102 | 55—57 | 55¼—56½ |
| 2,600,000 | ,, | ,, | 3½ | 26/3 | Gas Light and Coke: 3½ p.c. max. | 76—79 | 42—45 | 42½—44 |
| 4,062,235 | ,, | ,, | 4 | 4% | Gas Light and Coke: 4 p.c. Con. Pref. | 96—99 | 57—60 | 58½ |
| 4,674,850 | ,, | June 15 | 3 | 3% | Gas Light and Coke: 3 p.c. Con. Deb | 72½—74½ | 49—52 | 50½—51½ |
| 130,000 | ,, | Dec. 11 | 10 | 10% | Gas Light and Coke: 10 p.c. Bonds. | ... | ... | ... |
| 82,500 | ,, | Mar. 11 | 5 | 3⅜% | Hastings & St. L. 5 p.c. | ... | 48—53 | ... |
| 258,740 | ,, | ,, | 3½ | 2⅜% | Do. 3½ p.c | 87—89 | 34—39 | ... |
| 70,000 | 10 | May 12 | 11 | 5½† | Hongkong & China, Ltd | 16½—16¾ | 5—6 | ... |
| 86,600 | Stk. | Mar. 11 | 9 | 5⅞% | Hornsey 7 p.c. | ... | 75—85 | ... |
| 131,000 | ,, | Mar. 30 | 7½ | 3⅜% | Ilford A and C | 151—154 | 76—81 | ... |
| 65,780 | ,, | ,, | 6½ | 2⅜% | Do. B | 115—118 | 55—60 | ... |
| 65,500 | ,, | June 30 | 4 | 4% | Do. 4 p.c. Deb. | 92—94 | 53—55 | ... |
| 1,976,000 | ,, | May 27 | 9 | — ‡ | Imperial Continental | 150—160 | 131—136 | 131—133 |
| 1,235,000 | ,, | Feb. 10 | 3½ | — ‡ | Do. 3½ p.c. Deb. Red. | 84—86 | 77—82 | 79 |
| 235,342 | ,, | Mar 30 | 6½ | 3⅜% | Lea Bridge Ord. 5 p.c. | 119—121 | 67—72 | ... |
| 2,498,905 | ,, | Feb. 26 | 10 | 37/6 | Liverpool 5 p.c. Ord.: A | 211—213 | ... | 54½ |
| | | | | | Liverpool 5 p.c. Ord.: B | 146—148 | ... | ... |
| 306,083 | ,, | June 26 | 4 | 4% | Do. 4 p.c. Pr. Deb. Stk | ... | ... | ... |
| 164,716 | ,, | Feb. 25 | 7/5/0 | 3⅜% | Maidstone 5 p.c. | ... | 52—57 | ... |
| 63,480 | ,, | Dec. 30 | — | 3% | Do. 3 p.c. Deb. | ... | 40— 43 | ... |
| 75,000 | 5 | June 11 | 6 | 3% | Malta & Mediterranean | 4¼—4½ | 1⅞—2⅛ | ... |
| 250,000 | 100 | Apl. 1 | 4½ | 4½% | Met. of Melbourne 4½ p.c. Deb. | 99—101 | 88—93 | ... |
| 541,920 | Stk. | May 27 | 4 | 6% | Monte Video, Ltd. | 11½—12 | 60—70 | ... |
| 1,875,892 | ,, | Feb. 25 | 4½ | 3⅜% | Newcastle & Gatsh'dCon. | 98¼—99¼ | 59—60 | ... |
| 329,705 | ,, | June 30 | 3½ | 3⅜% | Do. 3½ p.c. Deb. | 82—83 | 48¼—50½ | ... |
| 15,000 | 10 | Mar. 11 | — | 8% | North Middlesex 10 p.c. | ... | 12½—13½ | 7 13/16—8 1/16 |
| 55,940 | 10 | ,, | 7/14/0 | 5⅜% | ,, 7 p.c. | 14—15 | 7⅛—8⅛ | ... |
| 300,000 | Stk | May 12 | 8 | 8% | Oriental, Ltd. | 117—122 | 87—92 | ... |
| 60,000 | 5 | Mar. 26 | 10 | 1/- | Ottoman, Ltd. | 7½—7⅞ | 2—3 | ... |
| 188,120 | Stk. | June 30 | — | 3½% | Plym'th & Stoneh'se 5 p.c. | ... | 53—58 | ... |
| 60,000 | 50 | Feb. 25 | 13 | 7½% | Portsea Island, B | 128—131 | 65—70 | ... |
| 100,000 | 50 | ,, | 12 | 6¾% | Do. C | 118—121 | 50—55 | ... |
| 249,980 | 5 | April 29 | 8 | — | Primitiva Ord. | 5⅛—6 | 1⅝—1⅞ | ... |
| 499,960 | 5 | June 26 | 5 | — | Do. 5 p.c. Pref. | 4⅜—5 | 1⅛—1½ | ... |
| 521,600 | 100 | June 1 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 65—67 | ... |
| 600,000 | Stk. | Jan. 27 | 4 | 4% | Do. ,, ,, 1911 | ... | 37—40 | ... |
| 546,198 | ,, | June 30 | 4 | 4% | River Plate 4 p.c. Deb. | 85—87 | 36—39 | ... |
| 150,000 | 10 | Mar. 30 | 6 | 6/- | San Paulo: 6 p.c. Pref. | 10½—11 | 5¼—6¼ | ... |
| 125,000 | 50 | June 30 | 5 | 5% | San Paulo: 5 p.c. Deb. | 47—49 | 34—39 | ... |
| 135,000 | Stk. | Mar. 30 | 10 | 5% | Sheffield A | 223—224 | 62—64 | ... |
| 209,984 | ,, | ,, | 10 | 4½% | Do. B | 222—224 | 62—64 | ... |
| 523,500 | ,, | ,, | 10 | 5⅛% | Do. C | 220—222 | 61—63 | ... |
| 133,201 | Stk. | Sept. 15 | 4 | 4% | Shrewsbury 5 p.c. | ... | ... | ... |
| 90,000 | 10 | June 30 | 9 | 8% | South African | 10¼—11¼ | 8—10 | ... |
| 6,609,895 | Stk. | Feb. 10 | 5/4/0 | 5% | South Met. Ord. | 111—113 | 67—69 | 67½—68½ |
| 250,000 | ,, | July 14 | — | 5% | Do. Red. Pref. | ... | 91—93* | ... |
| 1,895,445 | ,, | ,, | 3 | 5% | Do. 5 p.c. Deb. | 72½—74½ | 46—49* | ... |
| 224,820 | ,, | Feb. 25 | 3½ | 7½% | South Shields Con. Stk. | 157—159 | 85—87 | ... |
| 1,087,795 | ,, | ,, | 6 | 3½% | S'th Suburb'n Ord. 5 p.c. | 114—116 | 60—65 | 73½ |
| 368,837 | ,, | June 30 | 5 | 5% | Do. 5 p.c. Deb. Stk. | 116—118 | 71—76 | ... |
| 647,740 | ,, | May 12 | 7½ | 3½% | Southampton Ord. | 99—102 | 55—58 | ... |
| 121,275 | ,, | June 30 | 4 | 4% | Do. 4 p.c. Deb. Stk | ... | 56—58 | ... |
| 120,000 | ,, | Feb. 25 | — | 3½% | Tottenham: A 5 p.c. | 135—138 | 59— 63 | ... |
| 782,275 | ,, | ,, | 6 | 2⅝% | Tottenham District: B 5½ p.c. | 115—117 | 50— 55 | 54½ |
| 181,255 | ,, | June 15 | 4 | 4% | Tottenham District: 4 p.c. Del | 87—89 | 52—55 | ... |
| 182,380 | 10 | Dec. 30 | 5 | — | Tuscan, Ltd. | 5—6 | 1—2 | ... |
| 149,900 | 10 | July 1 | 5 | 3% | Do. 5 p.c. Deb. Red | 93—95 | 45— 50 | ... |
| 236,476 | Stk. | Feb. 25 | 5 | 4⅛% | Tynemouth 5 p.c. max | 108½—109 | 68— 70 | ... |
| | | | | | Wandsworth, Wimbledon, and Epsom— | | | |
| 30,000 | ,, | Feb. 25 | 8½ | 17/6 | Wandsworth A 5 p.c. | 131—136 | 78—83 | ... |
| 455,636 | ,, | ,, | 6½ | 32/6 | Do. B 5½ p.c. | 129—134 | 55—60 | ... |
| 108,075 | ,, | ,, | — | 33/3 | Do. C | ... | 55— 60 | ... |
| 140,865 | ,, | ,, | — | 33/3 | New Ordinary | ... | 55— 60 | ... |
| 152,000 | ,, | ,, | 6½ | 26/3 | Wimbledon 5 p.c. | 117—122 | 57— 62 | ... |
| 98,000 | ,, | ,, | 6½ | 32/6 | Epsom 5 p.c. | 121—126 | 55— 60 | ... |
| 88,416 | | June 30 | 3 | 3% | 4 p.c Deb Stk | 66—69 | 40—45 | ... |

* Ex Div. † Next dividend will be at this rate ‡ See "Correspondence" column, *ante* p. 166.

In consequence of the prevailing industrial situation, the Co-Partnership Exhibition and Congress, which was to have been held at the Crystal Palace this year, has been postponed until a date, to be decided upon later, in 1922.

Mr. George Mitchell, the Chief Outdoor Fittings Foreman to the Maidstone Gas Company, was elected a Town Councillor for the Bridge Ward on Tuesday of last week, defeating his opponent, a labour representative and trades union organizer, by 464 votes to 104.

The Directors of the Broadstairs Gas Company have instructed Messrs. A. & W. Richards to issue £12,500 of 7½ p.ct. redeemable debenture stock, at par. It is to be redeemed at par on Dec. 31, 1926, 1931, or 1936, at the option of the purchaser. Applications should be sent in by July 23. The capital is required to meet the outlay on a railway siding, and the cost of extensions and improvements rendered necessary by the steadily growing demands for gas.

The Stoke-on-Trent Borough Gas Committee last week expressed dissatisfaction at being asked 10s. per ton increase in the price of coal at the pithead, making the price about 50s. per ton at the pit. The Committee stated that the stoppage had cost them £14,000. It was decided to call the attention of the President of the Board of Trade and Mr. F. Hodges to the matter.

The Turbine Furnace Company, Ltd., of No. 238B, Gray's Inn Road, W.C., have received orders for their furnaces from the Beverley Gas Department (two sets—one for a Cornish and one for a Lancashire boiler); for the Coventry Gas-Works (through Messrs. Thompson, Ltd., of Wolverhampton); and a repeat order from the South Metropolitan Gas Company, for their Vauxhall works. The furnace is claimed to be specially suitable for gas-works, as the bars are indestructible by heat; four years of the fiercest Irish anthracite leaving the bars untouched, even on the surface.

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**WANTED — Works Foreman (170** Million Works). Good Carbonizer, Experience with Purifiers, Sulphate Plant, and Carburetted Water-Gas Plant.
Give Full Particulars and state Wages, &c., to W. ROGERSON, Engineer and Manager, Gas-Works, MIDDLETON.

**WANTED—Assistant Rental Clerk** and SHOWROOM SALESMAN. Good Knowledge of Gas Apparatus Essential.
Apply, stating Experience, Age, and Salary required, to the ENGINEER and MANAGER, GAS-WORKS, ORMSKIRK.

**FYLDE WATER BOARD.**

**WANTED—An Experienced Mechanic** accustomed to Repairing and Testing Water Meters and Water Fittings of various makes.
Apply, stating Age, Qualifications, and Wages required, to C. ARTHUR, Clerk to the Fylde Water Board, BLACKPOOL.

**WANTED—First-Rate Retort Setter** with wide experience of Modern Work.
Apply stating Age, married or single, full Particulars and Wages expected to the GAS AND WATER ENGINEER, Aldershot Gas, Water, and District Lighting Company, VICTORIA ROAD, ALDERSHOT.

## PLANT, &c., FOR SALE & WANTED.

**GAS ENGINEERS AND MANAGERS.**

**LIST of Modern Gas Plant just issued** Copy willingly sent on application.
This comprises Retort Mountings, Condensers, Washers, Scrubbers, Purifiers, Gasholders, Exhausters, and Sundries. Complete Installations, Renewals, and Extensions.
It will pay you to ask us to quote.
FIRTH BLAKELEY, SONS, AND CO., LTD., CHURCH FENTON, via LEEDS.

**GAS PLANT FOR SALE—BARGAINS.**

**GASHOLDERS with New Steel Tanks,** 172,000 c.ft., 115,000 c.ft., and several smaller down to 2000 c.ft. capacity.
PURIFIERS, Sets of 8 ft., 9 ft., 12 ft., and 16 ft. Square.
TOWER SCRUBBER, about ¾ million cubic feet capacity per day, by Kirkham; one about 200,000 c.ft. per day by Holmes.
STATION METER, about 40,000 c.ft. per hour, overhauled, and Several Smaller Sizes.
CONDENSERS, Set of Eight Annulars, outer tubes 36 in. diameter, by 25 ft. high, Inner Tubes Renewed, and 14 in. Diagonal Tubes. Equal to New. Two Sets of Four if desired. Other sizes on Stock.
FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH FENTON, via LEEDS.

**HIGH-CLASS LANCASHIRE BOILERS.**

**FOR SALE—**

| | | | | |
|---|---|---|---|---|
| One | 30 ft. by 9 ft. dia. | for | 180 lbs. | W.P. |
| One | 30 ft. by 8 ft. „ | „ | 180 „ | „ |
| Two | 30 ft. by 8 ft. 6 in. dia. | for | 160 lbs. | W.P. |
| Three | 30 ft. by 9 ft. dia. | for | 150 lbs. | W.P. |
| Two | 30 ft. by 8 ft. „ | „ | 160 „ | „ |
| Four | 30 ft. by 8 ft. „ | „ | 130 „ | „ |
| Two | 30 ft. by 8 ft. 6 in. dia. | for | 120 lbs. | W.P. |
| Four | 30 ft. by 8 ft. dia. | for | 100 lbs. | W.P. |
| One | 30 ft. by 7 ft. 6 in. dia. | for | 130 lbs. | W.P. |
| One | 30 ft. by 6 ft. 6 in. „ | „ | 160 „ | „ |
| Two | 28 ft. by 8 ft. dia. | for | 160 lbs. | W.P. |
| Three | 28 ft. by 7 ft. 6 in. dia. | for | 160 lbs. | W.P. |
| One | 24 ft. by 6 ft. dia. | for | 160 lbs. | W.P. |
| One | 20 ft. by 7 ft. „ | „ | 100 „ | „ |

In Stock, for IMMEDIATE DELIVERY, at Reasonable Prices.
DELIVERY and FIXING undertaken by experts at Lowest Rates.
RATCLIFFE AND SONS, "The Boiler House," HAWARDEN.

**GAS Economizer (12979/21) for** Cooking Stove Rings. Tested at Coventry Gas-Works. Splendid results. No Fixing required.
Sample and Particulars to Gas Managers throughout the country. 1s., post free.
J. DIAS, 5, MONKS ROAD, COVENTRY.

**THE Yorktown and Blackwater Gas** Company have the following PLANT FOR DISPOSAL:—
Two Braddock's Weight-Loading DISTRICT GOVERNORS, with 10 in. Connections.
One Cast-Iron SULPHATE STILL, with Secondary Liming Chamber. Capacity, 10 cwt. per diem.
One Cast-Iron Parkinson STATION METER, with 6 in. Connections. Capacity 2400 c.ft. per hour.
Apply to HENRY J. RANDALL, Engineer and Manager, Gas Offices, CAMBERLEY, SURREY.

**GASHOLDER and Steel Tank, 20,000** c.ft. capacity, Nearly New, Cheap for quick Sale.
FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH FENTON.

## CONTRACTS OPEN.

**LEEK URBAN DISTRICT COUNCIL.**

**THE Lighting Committee of the above** Council invite TENDERS for the Supply of 10,000 Tons of WASHED or SCREENED GAS NUTS, or SCREENED GAS COAL for the period ending June 30, 1922. Delivery to be made at the Gas-Works Sidings, North Staffordshire Railway, Leek.
Tenders to be sent to H. Henshaw, Esq., Clerk, Town Hall, Leek, not later than Monday, July 25, 1921.
For any further Particulars apply to the undersigned.
R. H. GINMAN,
Gas Engineer and Manager.

**KIRKBY-IN-ASHFIELD URBAN DISTRICT COUNCIL.**

(GAS DEPARTMENT)

**THE above Council invite Tenders for** the Supply of 1000 Tons of Yorkshire Screened GAS COAL or GAS NUTS over Six Months ending Feb. 28, 1922.
Tenders to be lodged with the undersigned not later than July 26, 1921.
G. M. GRIBBLE,
Engineer and Manager.

**MANCHESTER CORPORATION.**

(GAS DEPARTMENT.)

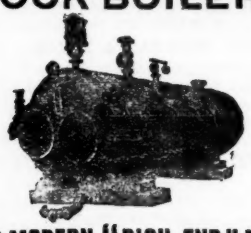
TO OIL IMPORTERS AND OTHERS.

**THE Gas Committee of the Corporation** of Manchester are prepared to receive TENDERS for the Supply of about 3000 Tons of OIL for the Manufacture of Carburetted Water Gas, for Delivery during the Month of August, 1921.
Conditions of Contract and further Particulars may be obtained on Application (in writing only) to Mr. Godfrey W. Kaye, Secretary of the Gas Department.
Sealed Tenders and Samples, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be Delivered at the Gas Offices, Town Hall, Manchester, not later than 10 a.m. on Wednesday, the 27th of July, 1921.
The Corporation do not bind themselves to accept the lowest or any Tender.
By order,
THOMAS HUDSON,
Town Clerk.
Town Hall, Manchester,
July 9, 1921.

MASTIC JOINTING CEMENT FOR STEAM GAS WATER JOINTS
F. K. HOUSE & Co. 68, FALKNER ST. LIVERPOOL

JOHN J.
**GRIFFIN**
& SONS, LTD.,
KEMBLE ST.,
KINGSWAY, LONDON, W.C.
*MAKERS OF ALL THE*
**"BOYS" GAS CALORIMETERS**
which have been in daily use in all the Official Testing Stations in London since the calorimetric test was introduced in 1906.
**PYROMETERS AND THERMOMETERS FOR TECHNICAL & INDUSTRIAL PURPOSES.**

**NOTE NOTE**
**NEW ADDRESS**
**TELEPHOS LTD.,**
**VAUGHAN ROAD, HARROW, N.W.**
Telephone: HARROW 777. Telegrams: "PILOTLESS, HARROW."
**TELEPHOS GAS SWITCH AND BROADBERRY STREET LAMP CONTROLLER.**
*Ask for Particulars and Prices.*

**STOCK BOILERS.**

**MOST MODERN "DISH END" TYPE.**
WITH CORRUGATED SECTIONS.

| | | | | |
|---|---|---|---|---|
| One | 30 ft. 0 in. | × 9 ft. 3 in. | × 150 lbs. | W.P. |
| Two | 30 ft. 0 in. | × 9 ft. 3 in. | × 160 lbs. | W.P. |
| One | 30 ft. 0 in. | × 9 ft. 3 in. | × 120 lbs. | W.P. |
| One | 30 ft. 0 in. | × 8 ft. 6 in. | × 160 lbs. | W.P. |
| One | 30 ft. 0 in. | × 8 ft. 3 in. | × 175 lbs. | W.P. |
| Two | 30 ft. 0 in. | × 8 ft. 3 in. | × 160 lbs. | W.P. |
| Two | 30 ft. 0 in. | × 8 ft. 3 in. | × 120 lbs. | W.P. |
| Four | 30 ft. 0 in. | × 8 ft. 3 in. | × 100 lbs. | W.P. |
| One | 28 ft. 0 in. | × 7 ft. 6 in. | × 160 lbs. | W.P. |
| Two | 28 ft. 0 in. | × 7 ft. 6 in. | × 130 lbs. | W.P. |
| Five | 28 ft. 0 in. | × 7 ft. 6 in. | × 120 lbs. | W.P. |
| Four | 28 ft. 0 in. | × 7 ft. 3 in. | × 160 lbs. | W.P. |
| Eight | 24 ft. 0 in. | × 7 ft. 3 in. | × 120 lbs. | W.P. |
| Two | 28 ft. 0 in. | × 7 ft. 3 in. | × 120 lbs. | W.P. |
| One | 24 ft. 0 in. | × 6 ft. 6 in. | × 120 lbs. | W.P. |
| One | 23 ft. 6 in. | × 7 ft. 3 in. | × 160 lbs. | W.P. |

*Also other sizes and Pressures Ready for Immediate Despatch.*
REPAIRS TO ALL TYPES OF BOILERS BY FIRST-CLASS MEN.
**John Thompson (Wolverhampton), Ltd.**
ETTINGSHALL, WOLVERHAMPTON, Eng.

R. & J. DEMPSTER, LTD., CONNAUGHT BANGOR, 24, VICTORIA STREET, S.W. 1
**HEAD, WRIGHTSON, & Co., LD., for PURIFIERS, &c.**